Annex B3: Habitats Regulation Assessment Report

Standard Gate two submission for London Water Recycling SRO

Notice – Position Statement

This document has been produced as the part of the process set out by RAPID for the development of the Strategic Resource Options (SROs). This is a regulatory gated process allowing there to be control and appropriate scrutiny on the activities that are undertaken by the water companies to investigate and develop efficient solutions on behalf of customers to meet future drought resilience challenges.

This report forms part of suite of documents that make up the 'Gate 2 submission.' That submission details all the work undertaken by Thames Water in the ongoing development of the proposed SRO. The intention at this stage is to provide RAPID with an update on the concept design, feasibility, cost estimates and programme for the schemes, allowing decisions to be made on their progress.

Should a scheme be selected and confirmed in the Thames Water final Water Resources Management Plan (WRMP), in most cases it would need to enter a separate process to gain permission to build and run the final solution. That could be through either the Town and Country Planning Act 1990 or the Planning Act 2008 development consent order process. Both options require the designs to be fully appraised and, in most cases, an environmental statement to be produced. Where required that statement sets out the likely environmental impacts and what mitigation is required.

Community and stakeholder engagement is crucial to the development of the SROs. Some high-level activity has been undertaken to date. Much more detailed community engagement and formal consultation is required on all the schemes at the appropriate point. Before applying for permission Thames Water will need to demonstrate that they have presented information about the proposals to the community, gathered feedback and considered the views of stakeholders. We will have regard to that feedback and, where possible, make changes to the designs as a result.

The SROs are at a very early stage of development, despite some options having been considered for several years. The details set out in the Gate 2 documents are still at a formative stage.

Disclaimer

This document has been written in line with the requirements of the RAPID Gate 2 Guidance and to comply with the regulatory process pursuant to Thames Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solutions presented in this document be taken forward, Thames Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

LONDON EFFLUENT REUSE SRO

B.3. Habitats Regulations Assessment Report

Report for: Thames Water Utilities Ltd

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Customer:
Thames Water Utilities Ltd

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EXECUTIVE SUMMARY

London Effluent Reuse has been identified as a Strategic Resource Option (SRO) in the Price Review 2019 Final Determination, following submission of Water Resources Management Plans in 2019, with funding allocated to Thames Water. As part of the assessment of water companies' PR19 business plans, Ofwat introduced proposals to support the delivery of SROs and set out an associated gated process for the co-ordination and development of a consistent set of strategic water resource options. This gated process provides a mechanism for the industry, regulators, stakeholders and customers to input into the development and scheduling of strategic solutions, through a combined set of statutory and regulatory processes.

As the Gate 1 and Gate 2 submissions do not form a statutory plan or project, the principles of the HRA process were applied to help identify risks to feasibility and deliverability of the schemes; this is referred to as an *informal* Habitats Regulations Assessment (HRA). An *informal* HRA was produced to support Thames Water's Gate 1 submission in June 2021 and included early consultation with Natural England. This *informal* HRA for the Gate 2 submission, builds on the work of the Gate 1 assessment and, as per the All Company Working Group (ACWG) guidelines[1], aims to improve the detail and breadth of studies. This has been completed alongside the further development of the concept solution designs, helping to identify risks to feasibility and deliverability of the schemes and reduce uncertainty in terms of environmental impact for a key decision point for strategic solutions.

For Gate 1, the London Effluent Reuse SRO was set out as four source options and a range of sizes. One option was in east London, utilising final effluent from Beckton Sewage Treatment Works (STW) (Beckton water recycling scheme). The other three options were in west London, utilising crude sewage or final effluent from Mogden STW to a maximum total reduction of 200 Ml/d, with differing discharge locations in the freshwater River Thames: Mogden water recycling scheme, Mogden South Sewer scheme and Teddington Direct River Abstraction (DRA) scheme. During the course of Gate 2, Thames Water took the decision to pause development of the Mogden South Sewer scheme due to limitations on available flow within the sewer, cost of the scheme and regional modelling not selecting the scheme under any water resources planning horizon scenario. Similarly, development of the pipeline variant associated with the Beckton water recycling scheme was paused due to the increasing costs associated with trenchless pipeline installation for greater lengths of the route to avoid environmental and planning issues, with the Beckton water recycling scheme progressed through Gate 2 featuring a tunnel conveyance.

Therefore, the Gate 2 *informal* HRA Stage 1 Screening assessment has revisited the three remaining schemes, informed by a more detailed conceptual design produced by the team engineers; notably the refinement of the conveyance routes and associated infrastructure (e.g. shaft locations), to identify if any of the schemes could lead to Likely Significant Effects (LSEs) on European sites.

The *informal* HRA Stage 1 Screening assessment concluded that Beckton water recycling scheme, Mogden water recycling scheme and Teddington DRA scheme have the potential to cause Likely Significant Effects (LSEs) on European sites alone. This was due to LSEs on qualifying habitats and species of the Lee Valley Special Protection Area (SPA) and Ramsar site, Thames Estuary and Marshes SPA and Ramsar site, South West London Waterbodies SPA and Ramsar site and Richmond Park Special Area of Conservation (SAC).

Therefore *informal* HRA Stage 2 Appropriate Assessments were required to determine whether Beckton water recycling scheme, Mogden water recycling scheme and Teddington DRA scheme would result in an adverse effect on the integrity of European sites, in light of conservation objectives. It was concluded, that with implementation of additional mitigation measures the majority of impact pathways could be suitably controlled such that the schemes would not result in an adverse effect on the integrity of European sites alone.

Further work is required to determine species presence in a number of locations (e.g. use of Barking Creek by Thames Estuary and Marshes SPA and Ramsar bird species) and both the noise and air quality assessments refined, with specific modelling of traffic and plant emissions to be undertaken for the latter at Gate 3.

An in-combination assessment was also undertaken to determine if the London Effluent Reuse schemes from west London had low level residual effects that could lead to an in-combination effect with the east London Beckton water recycling scheme. No in-combination effects were identified. In-combination effects of the

[1] Environment Agency, Drinking Water Inspectorate & Ofwat (2022). Strategic regional water resource solutions guidance for gate two. RAPID, 1 – 35.

London Effluent Reuse SRO with local plans and projects was also considered, and no likely significant effects on European sites were identified. This assessment is based on information available at the time of writing.

Table A Summary of Gate 2 *Informal* Habitats Regulations Assessment (HRA) Stage 1 Screening and Stage 2 Appropriate Assessments of the London Effluent Reuse SRO

Schemes	Is scheme likely to have a significant effect on European site(s) alone in the absence of mitigation?	Appropriate assessment required?	Adverse effect on integrity of European site(s) alone?	Effect in-combination with other plans and projects?
Teddington DRA	Yes – Richmond Park SAC	Yes	No – with mitigation measures	No – with mitigation measures
Beckton water recycling	Yes – Lee Valley SPA/ Ramsar and Thames Estuary and Marshes SPA/ Ramsar	Yes	No – with mitigation measures	No – with mitigation measures
Mogden water recycling	Yes – South West London Waterbodies SPA/ Ramsar	Yes	No – with mitigation measures	No – with mitigation measures

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1. INTRODUCTION

1.1 BACKGROUND

London Effluent Reuse has been identified as a Strategic Resource Option (SRO) in the Price Review 2019 Final Determination, with funding allocated to Thames Water. As part of the assessment of water companies' PR19 business plans, Ofwat introduced proposals to support the delivery of SROs and set out an associated gated process for the co-ordination and development of a consistent set of strategic water resource options. This gated process provides a mechanism for the industry, regulators, stakeholders and customers to input into the development and scheduling of strategic solutions, through a combined set of statutory and regulatory processes.

The primary objective of the Gate 2 environmental assessment studies is to provide regulatory assessments for the London Effluent Reuse SRO and to ensure environmental and social considerations (including mitigation and net gain opportunities) of options are included in regional plans and that detailed feasibility, concept design and multi-solution decision making has been suitably informed.

1.2 PURPOSE OF REPORT

This report is part of three environmental assessment reports: B.2.3. Habitats Regulations Assessment (HRA) (this report), B.2.4. Water Framework Directive (WFD) and B.2.5. Initial Environmental Appraisal (IEA), which informally assess the environmental impacts of the London Effluent Reuse SRO against their relevant legislation, and allow the schemes to progress through Regulators' Alliance for Progressing Infrastructure Development (RAPID) Gate 2: *Detailed feasibility, concept design and multi-solution decision making* and onward to RAPID Gate 3: *Developed design, finalised feasibility, pre-planning investigations and planning applications*.

As the Gate 1 and Gate 2 submissions do not form a statutory plan or project, the principles of the HRA process were applied to help identify risks to feasibility and deliverability of the schemes; this is referred to as an *informal* HRA. The *informal* HRA is supported by a series of Environmental Assessment Reports[2] (Annex B.2.) which document the set of environmental assessments of the London Effluent Reuse SRO. The scope and approach to the HRA and underpinning environmental evidence provided in these reports was set out in the B.2.1. Gate 2 Scoping Report[3] and consulted on with the National Appraisal Unit (NAU) in November 2021, plus subsequent guidance released from the NAU regarding the Gate 2 submission in April 2022[4].

1.3 REQUIREMENTS FOR HABITATS REGULATIONS ASSESSMENT

The All Company Working Group (ACWG) guidance states that the HRA for each SRO should be undertaken in accordance with available guidance for England and Wales and should be based on a precautionary approach as required under the HRA process. The requirement for a HRA is established through the Conservation of Habitats and Species Regulations 2017 (as amended), commonly referred to as the Habitats Regulations. The Habitats Regulations state that 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.

As such, each SRO should meet the requirements of the Habitats Regulations before implementation.

The amended 2017 Habitats Regulations have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. The national site network includes:

[2] Ricardo (2022) London Effluent Reuse SRO, Gate 2 Environmental Assessment Reports

[3] Ricardo (2021) London Effluent Reuse SRO, Gate 2 Environmental Scoping Report

[4] Strategic regional water resource solutions: detailed feasibility and concept design. Gate Two Guidance, NRW, NE, NEAS, April 2022.

- existing Special Areas of Conservation (SACs)[5] and Special Protection Areas (SPAs) [6]
- new SACs and SPAs designated under these Regulations

Designated Wetlands of International Importance (known as Ramsar sites) do not form part of the National Site Network. Many Ramsar sites overlap with SACs and SPAs and may be designated for the same or different species and habitats. All Ramsar sites are protected in the same way as SACs and SPAs. For ease of reference through this HRA report, all of these designations are collectively referred to as "European sites".

As per Natural England (NE) guidance[7], any HRA should also consider any European Marine Protected Areas (MPAs) within England's inshore waters (out to 12 nautical miles) to support sites in achieving conservation objectives and to guide effective management. Thames Estuary and Marshes SPA is a European MPA that was identified within the study area[8].

As per the latest RAPID guidance a full HRA for a solution is not required until a planning and/or permit application (or its equivalent, for example a Development Consent Order), however the *principles* of the HRA process are applied during the gated process to identify *risks* to feasibility and deliverability of the schemes (alone and in-combination) as part of an *informal* HRA. As such there is no competent authority undertaking the integrity test.

This HRA report aims to establish whether the London Effluent Reuse SRO schemes are likely to have a significant effect on European sites, either alone or in-combination through the *informal* Stage 1 Screening and where likely significant effects have been identified (or uncertainty of an impact pathway remains), the potential for adverse effects on site integrity through the *informal* Stage 2 Appropriate Assessment. The staged process considered the implications of the scheme on the European 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), using data available to date and information on the conceptual design of the scheme and high level construction details. Significantly, HRA is based on a rigorous application of the precautionary principle.

The completion of the Stage 2 Appropriate Assessments has considered the need for additional mitigation measures to avoid an adverse effect on site integrity (Section 4). Although some uncertainty remains regarding the presence of qualifying features at certain sites and demonstrating the effectiveness of mitigation measures, based on currently available information the *informal* Stage 2 Appropriate Assessment has concluded that there will be no adverse effects on site integrity as a result of London Effluent Reuse SRO. However, additional surveys have been recommended to reduce current uncertainty and inform the Stage 2 Appropriate Assessment conclusions at Gate 2. As such, a Stage 3 Alternative Solutions and Stage 4 Imperative Reasons of Over-riding Interest (IROPI) are not deemed to be required at Gate 2.

1.4 LONDON EFFLUENT REUSE STRATEGIC RESOURCE OPTIONS

For Gate 2, the London Effluent Reuse SRO is set out as four source options and a range of sizes. One option is in east London, utilising final effluent from Beckton Sewage Treatment Works (STW). The other three options are in west London, utilising crude sewage or final effluent from Mogden STW to a maximum total reduction of 200 Ml/d, with differing London Effluent Reuse discharge locations in the freshwater River Thames. The scheme descriptions below have been provided based on currently available information at Gate 2 and may be subject to change at Gate 3 based on amendments to scheme design. In addition, the volume of final effluent transfer for each scheme varies depending on water resources available and feasibility.

[5] SACs were 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.

[6] SPAs were 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).

[7] Help Note: Tips and advice on how to assess potential impacts of water company statutory plans on the marine environment1 – Focussing on Marine Conservation Zones (MCZ)

[8] Swanscombe Marine Conservation Zone (MCZ) was identified within the study area and therefore, an MCZ assessment has been included within the Initial Environmental Appraisal.

Full details of the conceptual design of the four schemes are provided in the Annex A Conceptual Design Reports[9] (CDR). High level summaries of each option are provided below.

1.4.1 Beckton water recycling scheme

Final effluent from Beckton STW would be treated at a new advanced water recycling plant (AWRP) within Beckton STW for advanced treatment. Recycled water would be conveyed via a new tunnel from the Beckton AWRP to Lockwood Pumping Station and then a Thames-Lee-Tunnel extension from Lockwood Pumping Station to a proposed new outfall located on a side channel of the freshwater Lee Diversion Channel, known as the Enfield Island Loop, upstream of the existing Thames Water Enfield intake to the King George V Reservoir. Additional abstraction for public water supply on a put/take basis would be through existing intakes in the lower Lee, to supplement the raw water supply to the Lee Valley reservoirs. The option reduces the final effluent at the extant Beckton STW outfall to the estuarine Thames Tideway.

The Beckton water recycling scheme has been assessed for Gate 2at 100 Ml/d, 200 Ml/d, and 300 Ml/d.

1.4.2 Mogden water recycling scheme

Final effluent from Mogden STW would be pumped in a new pipeline to a new AWRP located at a site near Kempton water treatment works (WTW)) for advanced treatment. Recycled water would be transferred in a new pipeline for discharge into the freshwater River Thames at a new outfall upstream of the existing Thames Water Walton intake. Additional abstraction for public water supply on a put-take basis would be through existing downstream intakes on the River Thames. AWRP wastewater and reverse osmosis (RO) concentrate would be conveyed back to Mogden STW inlet works via a return pipeline(s). There is an option that the AWRP wastewater could be discharged to the South Sewer for return to Mogden STW, but it is not possible to return the RO concentrate by this means. The scheme reduces the final effluent at the extant Mogden STW outfall to the estuarine Thames Tideway.

The Mogden water recycling scheme has been assessed for Gate 2at 50 Ml/d, 100 Ml/d, 150 Ml/d and 200 Ml/d.

1.4.3 Mogden South Sewer scheme

During Gate 2, Thames Water took the decision to pause development of the Mogden South Sewer scheme due to limitations on available flow within the sewer, cost of the scheme and regional modelling not selecting the scheme under any water resources planning horizon scenario.

The Mogden South Sewer scheme has not been progressed through Gate 2 environmental assessments, and so a dedicated assessment section is not included within this report. However, due to the similarities with the 50 Ml/d Mogden water recycling scheme (AWRP, discharge location and volume), the outcomes of that assessment can be considered representative of an assessment of a 50 Ml/d Mogden South Sewer scheme.

1.4.4 Teddington DRA scheme

Final effluent from Mogden STW would be subject to further treatment at a new tertiary treatment plant (TTP) at Mogden STW. The treated water would be transferred in a new pipe-jacked tunnel for discharge into the freshwater River Thames at a new outfall upstream of the tidal limit at Teddington Weir. Additional abstraction for public water supply on a take-put basis would be through a new intake from the freshwater River Thames, upstream of the new outfall. Abstracted water would be pumped into the nearby Thames-Lee Tunnel for transfer to Lockwood pumping station, part of Thames Water's Lee Valley reservoirs in North London. The option reduces the final effluent at the extant Mogden STW outfall to the estuarine Thames Tideway.

The Teddington DRA scheme has been assessed for Gate 2 at 50 Ml/d, 75 Ml/d, 100 Ml/d and 150 Ml/d.

1.5 CONSULTATION

As part of the Gate 2 consultation, a meeting was held with Natural England and the Environment Agency in early May 2022 to discuss the proposed approach to the *informal* HRA and discuss key issues that were to be revisited as part of the assessment. These issues included the loss of habitat within the Lee Valley SPA and Ramsar as part of the Beckton water recycling scheme and re-considering the potential for loss or deterioration

[9] Jacobs (2022) London Reuse Strategic Resource Option, Gate 2 Conceptual Design Reports.

of supporting offsite habitat for stag beetle with regards both the Epping Forest SAC and Richmond Park SAC. Feedback from Natural England and the Environment Agency regarding approach and key concerns regarding the London Effluent Reuse SRO were taken into consideration during the completion of the *informal* HRA.

1.6 STRUCTURE OF THE REPORT

This report presents the results of the HRA Stage 1 Screening of Likely Significant Effects (LSEs) and information to inform the *informal* Stage 2 Appropriate Assessment of Beckton water recycling, Mogden water recycling and Teddington DRA, using the best available information from desk studies including modelling outputs, data searches and survey results since Gate 1.

The report is divided into the following sections:

Section 1: This introduction.

Section 2: Methodology adopted for the *informal* HRA.

Section 3: *Informal* Stage 1 Screening of the Beckton water recycling, Mogden water recycling and Teddington DRA schemes.

Section 4: *Informal* Stage 2 Appropriate Assessments of the Beckton water recycling, Mogden water recycling and Teddington DRA schemes.

Section 5: In-combination assessment with other plans and projects.

Section 6: Conclusions and recommendations.

2. METHODOLOGY

The ACWG guidelines indicate that a HRA should be undertaken in accordance with available guidance[10,11,12,13,14,15,16,17] and should be based on a precautionary approach as required under the Conservation of Habitats and Species Regulations 2017 (as amended).

The *informal* HRA required for Gate 2 has been carried out in line with the ACWG current guidance for SRO Environmental Assessment. The requirements and outputs of the assessment are consistent with those in the WRSE Regional Plan Environmental Assessment Methodology Guidance, as well as the WRPG guidance for WRMP24.

The objective of this *informal* HRA is to establish whether any of the schemes for the London Effluent Reuse SRO is likely to have a significant effect on European sites (alone and in-combination with other plans and projects) through the Stage 1 Screening and if likely significant effects identified (or uncertainty remains regarding an impact pathway), the potential for adverse effects on site integrity through the Stage 2 Appropriate Assessment. In-combination assessments with other SROs, non-SRO options and other plans and projects, will be undertaken as part of the relevant regional plan or WRMP24 assessment processes. The in-combination assessment within this report determines the potential for in-combination effects within a localised Zone of Influence (ZoI) e.g. with major developments registered with the Local Planning Authority, key allocations within the Local Plans.

The ZoI for different impact pathways has been identified based on available guidance and site-specific impact assessments. For example, the potential adverse effects of air emissions on qualifying features due to proximity to main access roads has been considered when ecological receptors are present within 200 m. This is based on guidance developed by Highways England (LA105 Air Quality)[18] which highlights that ecological receptors should be considered within 200 m of the affected road network (roads which experience a significant change in traffic). The Natural England advice to competent authorities considering air impacts in HRAs also uses this distance[19].

As the Gate 2 submission does not form a statutory plan or project, the principles of the HRA process were applied to help identify risks to feasibility and deliverability of the schemes. An *informal* Stage 1 Screening assessment was undertaken as part of the initial screening exercise for each of the schemes and the risk of failing the integrity test was reviewed for each scheme, using the principles of the Stage 2 (*informal* Appropriate Assessment) assessment.

2.1 *INFORMAL* STAGE 1 SCREENING

For Gate 2, each scheme associated with the London Effluent Reuse SRO was considered as a whole to determine whether there are any *risks* of LSEs arising from construction or implementation activities and/or operation on one or more European sites, including SPAs[20], SACs[21] and Ramsar sites (known as the National Site Network within the UK) adopting the *principles* of HRA.

[10] Court of Justice for the European Union's ruling on People Over Wind and Sweetman ('Sweetman II') vs Coillte Teoranta, Case C-323/17.

[11] UK Government (2019). Guidance on the use of Habitats Regulations Assessment.

[12] UK Government (2019). Conservation of Habitats and Species Regulations (Amendment) (EU Exit).

[13] Natural England (2020). Guidance on how to use Natural England's Conservation Advice Packages in Environmental Assessments.

[14] Tyldesley, D. & Chapman, C. (2013). The Habitats Regulations Assessment Handbook, February 2021 edition UK: DTA Publications Limited.

[15] Environment Agency and Natural Resources Wales (2017). Water resources planning guideline – April 2017

[16] European Commission (2018). Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. European Union, 1-86.

[17] Defra (2012). The Habitats and Wild Birds Directives in England and its seas: Core guidance for developers, regulators & land/marine managers.

[18] Highways England (2019). LA 105 Air Quality. Sustainability and Environment Appraisal. 1 – 64.

[19] Natural England (2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations.

[20] 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).

[21] 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.

Updated GIS and design information was used to map the locations and boundaries of European sites in relation to the London Effluent Reuse SRO schemes. The attributes and targets of the European sites, which contribute to and define their integrity, current conservation status, and the specific sensitivities of the site were considered, with reference to:

- Standard Data Forms for SACs and SPAs and Information Sheets for Ramsar sites. An analysis of these information sources that identify the site's qualifying features;
- Article 12 reporting under the EU Birds Directive (which includes general information about the implementation of the Directive and the bird species' status and trends) and Article 17 reporting which captures the status and trends of Annex I habitat types and Annex II species;
- Site conservation objectives;
- Supplementary advice to the conservation objectives (SACO), where available;
- Site Improvement Plans; and
- the supporting Site of Special Scientific Interest's (SSSI) favourable condition tables where relevant and no SACOs applicable to the features were available.

This information was used to analyse how potential impacts of London Effluent Reuse SRO could affect the European sites.

The qualifying habitats and species of European sites are vulnerable to a wide range of impacts such as physical loss or damage of habitat, disturbance from noise, light, human presence, changes in hydrology (e.g. changes in water levels/flow, flooding), changes in water or air quality and biological disturbance (e.g. direct mortality, introduction of disease or non-native species). The review of the Gate 2 assessment considered any updates to the potential construction and operational effects as a result of monitoring and modelling data available in Gate 2 as well as any changes in scheme design.

In reviewing the likelihood of significant effects on European sites, particular consideration was given to the possible source-receptor pathways through which effects may be transmitted from activities associated with London Effluent Reuse SRO, to features contributing to the integrity of the European sites (e.g. surface water catchments, air, etc.). Costed/ embedded mitigation measures included within each scheme, regardless of potential for effects on European sites, in order to follow standard, best practice construction guidelines[22,23,24] were considered during the Stage 1 Screening.

The initial screening for LSEs on European sites as a result of London Effluent Reuse SRO at Gate 2 was determined on a proximity basis for many of the types of impacts, based on the potential closeness of the scheme locations to each European site (10 km radius from proposed infrastructure and within 500 m of potentially impacted reaches). Where impact pathways were identified at greater distances (>10 km) as a result of hydrological connectivity or identification of potential functionally linked habitat for example, European sites were screened in as appropriate. Consideration was also given to the NE SSSI Impact Risk Zone (IRZ) datasets. The IRZs are reviewed regularly to ensure they reflect the current understanding of specific site sensitivities and potential risks posed to SSSIs. Where the notified features of a European site and SSSI are different, the SSSI IRZs have been set so that they reflect both. As such, these IRZs were used in Gate 2 to help determine the likelihood of significant effects from a particular scheme on the interest features of the European site.

Schemes that will not have LSE alone but may have in-combination effects with other local plans and projects, will again be taken forward for further assessment.

[22] Guidance for Pollution Prevention (GPPs) provide environmental good practice guidance for the whole UK: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/

[23] Environment Agency (2001) Preventing pollution from major pipelines [online]. Available at https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.391.8549&rep=rep1&type=pdf. [Accessed 7 December 2021].

[24] Venables R. et al. (2000) Environmental Handbook for Building and Civil Engineering Projects. 2nd Edition. Construction Industry Research and Information Association (CIRIA), London.

2.2 *INFORMAL* STAGE 2 APPROPRIATE ASSESSMENTS

Where a *risk* of LSE is identified at HRA Stage 1 Screening (noting the precautionary principle), the scheme was subject to the *principles* of the Stage 2 *informal* Appropriate Assessment. The *informal* Stage 2 Appropriate assessment considered the potential impact pathways of the London Effluent Reuse SRO, both during construction and operation, that could impact on attribute targets associated with a European site's qualifying features.

2.2.1 Approach

2.2.1.1 Impact pathways

Where required, the potential impact pathways associated with the London Effluent Reuse SRO were considered in the context of their effect on the qualifying features for the sites under consideration. To determine if identified impact pathways could have an adverse effect on site integrity, the following parameters were used as appropriate to define the impact (i.e. mechanism by which effects are caused):

- Impact type - direct or indirect, positive or negative;
- Probability – the probability/likelihood of an impact occurring based on the change in physical environment
- Magnitude of impact – the 'amount' or intensity of an impact. This may sometimes be synonymous with 'extent' (see below) for certain impacts, such as habitat loss. This will be described as low, moderate or high magnitude based on the relevant qualifying features targets set out in the SACO and site specific factors;
- Extent of impact – the area over which the impact will be felt;
- Duration of impact – how long it will occur. The guidelines suggest that ecological impact durations should be described in terms of ecological characteristics (e.g. species lifecycles/longevity) rather than human timeframes;
- Timing of impact – when it will occur, taking note of seasonality;
- Frequency of impact – how often it will occur; and
- Reversibility of impact – whether recovery or reinstatement is possible.

2.2.1.2 Adverse effect

An Adverse Effect on Integrity (AEoI) is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature. In addition, an adverse effect would be one which causes a detectable reduction of the features for which a site was designated, at the scale of the site rather than the location of the impact.

The Habitats Directive defines the conservation status of habitats as 'favourable' when:

- Its natural range and area it covers within that range are stable or increasing; and
- The species structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future.

The Habitats Directive defines the conservation status of species as 'favourable' when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The assessment of adverse effects considered the current condition of the associated site in line with the relevant judgements in European Court of Justice and UK courts (e.g. the Waddenzee Judgement).

2.2.1.3 Integrity test

The integrity test is the conclusion of an appropriate assessment and requires the competent authority to ascertain whether the proposed London Effluent Reuse SRO (either alone or in-combination with other plans or projects), will have no adverse effect on site integrity. The following definition is provided by Defra: the integrity of the site is "*the coherence of its ecological structure and function, across its whole area, that enables*

it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified"[25].

2.2.1.4 Mitigation measures

The assessment considered specific mitigation measures that may be available to reduce the likelihood, magnitude, scale and duration of the effect on qualifying features, which can be applied at the Appropriate Assessment stage to inform the overall integrity test[26]. These measures included both avoidance and reduction measures, with the former being preferred.

2.2.2 Information to support the *informal* Stage 2 Appropriate Assessments

Both desk based assessments and survey data has been used to inform the *informal* Stage 2 Appropriate Assessment. For future assessments, where necessary, surveys have been recommended to provide site specific baseline data where evidence gaps have been identified to inform the Stage 2 Appropriate Assessment at Gate 3 and during the consenting process.

2.2.2.1 Baseline data

Protected species and non-statutory habitats (specifically Sites of Importance for Nature Conservation (SINCs)) data was requested from Surrey Biological Information Centre, Essex Field Club, Herts Environmental Records Centre and Greenspace Information for Greater London within the footprint of London Effluent Reuse SRO, plus a 2 km buffer. Wetland Bird Survey (WeBS) core count data from British Trust for Ornithology (BTO) was also requested where impact pathways to supporting habitat for overwintering birds was identified. This included the following sites:

- Beckton water recycling – King George V Reservoirs (24152), Banbury Reservoir (24108), Walthamstow Reservoirs excluding Banbury (24107), William Girling Reservoir (24151), Wanstead Flats (24077) and River Thames – Barking (24903).
- Mogden water recycling - Kempton Local Nature Reserve (24103) and Red House Reservoir (24104).

Preliminary Ecological Appraisals (PEAs), UK Habitats Classification (UKHabs) and River MoRPh surveys have been completed within the construction footprint and predicted ZoI during any future operation of Beckton water recycling, Mogden water recycling and Teddington DRA schemes. The specific surveys completed for each scheme have been summarised below:

- Beckton water recycling scheme – PEA (including UKHabs) of Beckton STW, conveyance route and discharge location. River MoRPh surveys completed on the River Lee and Barking Creek.
- Mogden water recycling scheme – UKHabs surveys at Mogden STW, potential AWRP site, conveyance route, Syon Park SSSI and Isleworth Ait.
- Teddington DRA – PEA (including UKHabs) of conveyance route and UKHabs surveys at Teddington intake and outfall, Ham Lands SINC and Mogden STW.

2.2.2.2 Hydraulic modelling

Both the *informal* Stage 1 Screening and *informal* Stage 2 Appropriate Assessments considered the outcomes of the detailed hydraulic modelling that was undertaken for the Gate 2 assessment of the London Effluent Reuse SRO during operation of Beckton water recycling, Mogden water recycling and Teddington DRA schemes, by specialist consultancies. Details of this work can be found in the "*London Effluent Reuse SRO: Aquatic Physical Environment Assessment Report*" (see Annex B.2.1).

2.2.2.3 Noise impact assessment for ornithological receptors

To support the Gate 2 *informal* HRA, and particularly understand the potential for construction activities to disturb the bird qualifying features where works are required in close proximity to SPAs and Ramsar sites, a specific desk based noise impact assessment was completed. Full details of the approach are provided in Appendix 1.

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[25] Defra Circular 01/2005. *Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and Their Impact Within The Planning System.* August 2005.

[26] The "People over Wind" or "Sweetman" judgment ruled that Article 6(3) of the Habitats Directive must be interpreted as meaning that mitigation measures should be assessed within the framework of an appropriate assessment and that it is not permissible to take account of mitigation measures at the screening stage.

Two of the London Effluent Reuse SRO schemes, Beckton water recycling scheme and Mogden water recycling scheme, have scheme components which are in close proximity to a number of designated sites with ornithological interest, such as the South West London Waterbodies SPA and Ramsar to the west, Lee Valley SPA and Ramsar to the north, and potential functionally linked habitat[27] of the Thames Estuary and Marshes SPA and Ramsar to the east.

Indicative noise modelling has been conducted to estimate noise levels due to construction activities (based on information in the CDRs and provided by the engineers) at selected receptor sites, to understand the magnitude of the impact. The noise calculations have been completed by John Hyde, Anglia Consultants, a Chartered Physicist and Member of the Institute of Acoustics who has over 30 years' experience as a noise and acoustics consultant.

The noise impact assessment covered the following:

- Identification of sensitive ornithological receptors.
- Preliminary assessment of baseline noise levels at receptors.
- Construction noise emission levels at sites of shafts and structures.
- Predicted noise levels at designated ornithological areas due to construction activities at nearby shaft and structures sites.

2.2.2.4 Air quality assessment of ecological receptors

Another potential impact to qualifying features in proximity to schemes of the London Effluent Reuse SRO is dust and emissions arising from construction sites, Heavy Goods Vehicle (HGV) movements, plant and Non-Road Mobile Machinery (NRMM).

An initial desk based risk assessment of the air quality impacts associated with the London Effluent Reuse SRO has been undertaken, both for human and ecological receptors. The full detail is provided in the Initial Environmental Appraisal, with a summary as follows.

The proposed construction sites and pipeline routes have been reviewed, in the context of screening distances for potentially significant air quality impacts (e.g. from Institute of Air Quality Management (IAQM) guidance relating to control of dust from construction[28], and guidance on assessment of the effects of air pollution on habitat sites[29]). This has considered proximity to sensitive nationally and internationally designated habitat sites. The nature of the construction activities likely to be carried out (e.g. excavation; demolition; construction; tunnelling; road vehicle movements) has also been considered.

An assessment of dust has been carried out where there are dust-sensitive ecological receptors:

- Within 50 m of the site boundary; or
- Within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A screening assessment of the potential air quality impacts on nearby sensitive ecological receptors due to traffic emissions during construction and operation has also been undertaken, based on the following criteria:

- Whether there are ecological receptors within 200 m of the SRO schemes. This is based on guidance developed by Highways England (LA105 Air Quality) highlights that ecological receptors should be considered within 200 m of the affected road network (roads which experience a significant change in traffic). The use of 200 m is therefore, informed by this guidance and professional judgement on

[27] The term 'functional linkage' refers to the role or 'function' that land or sea beyond the boundary of a European site might fulfil in terms of supporting the populations for which the site was designated or classified. Such an area of land or sea is therefore 'linked' to the site in question because it provides a (potentially important) role in maintaining or restoring a protected population at favourable conservation status (*Chapman C. & Tyldesley D. 2016. Functional linkage: How areas that are functionally linked to European sites have been considered when they may be affected by plans and projects - a review of authoritative decisions. Natural England Commissioned Reports, Number 207*).

[28] Institute of Air Quality Management IAQM (2017) Guidance on the Assessment of Dust from Demolition and Construction v1.1

[29] CIEEM (2021). Advisory Note: Ecological Assessment of Air Quality Impacts. Published online, CIEEM, 1 – 25.

distances that significant impacts could occur. The Natural England advice to competent authorities considering air impacts in Habitats Regulations Assessment also uses this distance[30].

- The existing baseline air quality concentrations for each scheme.
- A review of the additional traffic that will be associated with each of the schemes.

Based on this evaluation, areas and aspects of greater or lesser concern with regard to air quality have been identified, and recommendations for schemes which may require relocation/ redesign have been made, where possible, from the perspective of minimising air quality impacts. An indication of the measures required at HRA Stage 2 to minimise/mitigate air quality impacts have been provided, where impacts could be significant.

2.3 IN-COMBINATION ASSESSMENTS

It should be noted that the HRA in-combination assessment of the London Effluent Reuse SRO only considers local plans and projects within the ZoI. The in-combination assessment with WRMPs, Drought Plans (DPs) and other SROs has been considered within the Water Resources South East (WRSE) Regional Plan and Thames Water's Water Resource Management Plan 2024 (due for consultation in autumn 2022).

The ZoI and its associated plans or projects that are applicable to the in-combination assessment for the London Effluent Reuse SRO include:

1. The proposed construction route of Beckton water recycling scheme tunnel from Beckton STW, Lockwood pumping station and the River Lee, proposed construction route of Mogden water recycling scheme pipeline from Mogden STW to the River Thames and proposed construction route of Teddington DRA tunnel from Mogden STW to the River Thames.
2. The impacts on flow, velocity, depths, water level and flooding risk and subsequent impacts on the watercourses associated with the London Effluent Reuse SRO. This includes the freshwater River Thames, estuarine Thames tideway and freshwater Lee diversion channel.
3. The impacts on water quality and subsequent impacts on the watercourses associated with a London Effluent Reuse SRO (as listed above).

[30] Natural England (2018) Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations.

3. *INFORMAL* STAGE 1 SCREENING

3.1 RISK OF LIKELY SIGNIFICANT EFFECTS

The London Effluent Reuse SRO is associated with a number of European sites including SACs[31], SPAs[32] and Ramsar[33] sites as shown in Figure 3-1 - Figure 3-3.

As described in Section 2, this *informal* Stage 1 Screening has screened each scheme for any European sites within a 10 km radius of infrastructure, hydrologically connected and/ or within 500 m of potentially impacted reaches. European sites have also been screened into the *informal* Stage 1 Screening where potential functionally linked habitat has been identified within the ZoI. The SSSI IRZ has also been considered when selecting European sites that require assessment.

The *informal* Stage 1 Screening of the associated European sites for potential LSE as result of London Effluent Reuse schemes (alone and in-combination) is summarised in Table 3-1 with detailed assessments provided in Appendix 2 . The assessment has been undertaken on a precautionary basis.

Where uncertainty has been identified, this uncertainty indicates that a confident conclusion of no risk of LSE is not yet possible, in most cases due to the very early stage of option development (meaning specific design and location information may not be available to allow a full appraisal of the risk of likely effects). Where uncertainty remains, an *informal* Stage 2 Appropriate Assessment is required to either confirm a risk of adverse effects on European site integrity related to a scheme or to confirm that no adverse effects are expected.

The potential impact pathways that were identified during the *informal* screening form the scope of the *informal* appropriate assessment are summarised in Section 4. As noted in Section 2, the potential for impact pathways to result in the risk of LSE were identified using the results from hydraulic modelling, noise impact assessment and air quality assessments that were undertaken for the London Effluent Reuse SRO at Gate 2.

3.1.1 Beckton water recycling scheme

The *informal* Stage 1 Screening identified the risk of LSE associated with the construction of the Beckton water recycling scheme tunnel alone to qualifying features of the Lee Valley SPA and Ramsar site and Thames Estuary and Marshes SPA and Ramsar site. The risk of LSE has also been identified during the operation of the Beckton water recycling scheme alone on the Thames Estuary and Marshes SPA and Ramsar site. For the purposes of this assessment it has been assumed that Barking Creek provides functionally linked saltmarsh and mudflat habitat to qualifying features of the Thames Estuary and Marshes SPA and Ramsar site. No low level residual effects were identified from Beckton water recycling scheme that could lead to likely significant effects in-combination with other plans and projects.

3.1.2 Mogden water recycling scheme

A risk of LSE associated with the construction of the Mogden water recycling scheme pipeline alone was identified for the qualifying features of South West London Waterbodies SPA and Ramsar site. No low level residual effects were identified from Mogden water recycling scheme that could lead to likely significant effects in-combination with other plans and projects.

3.1.3 Teddington DRA scheme

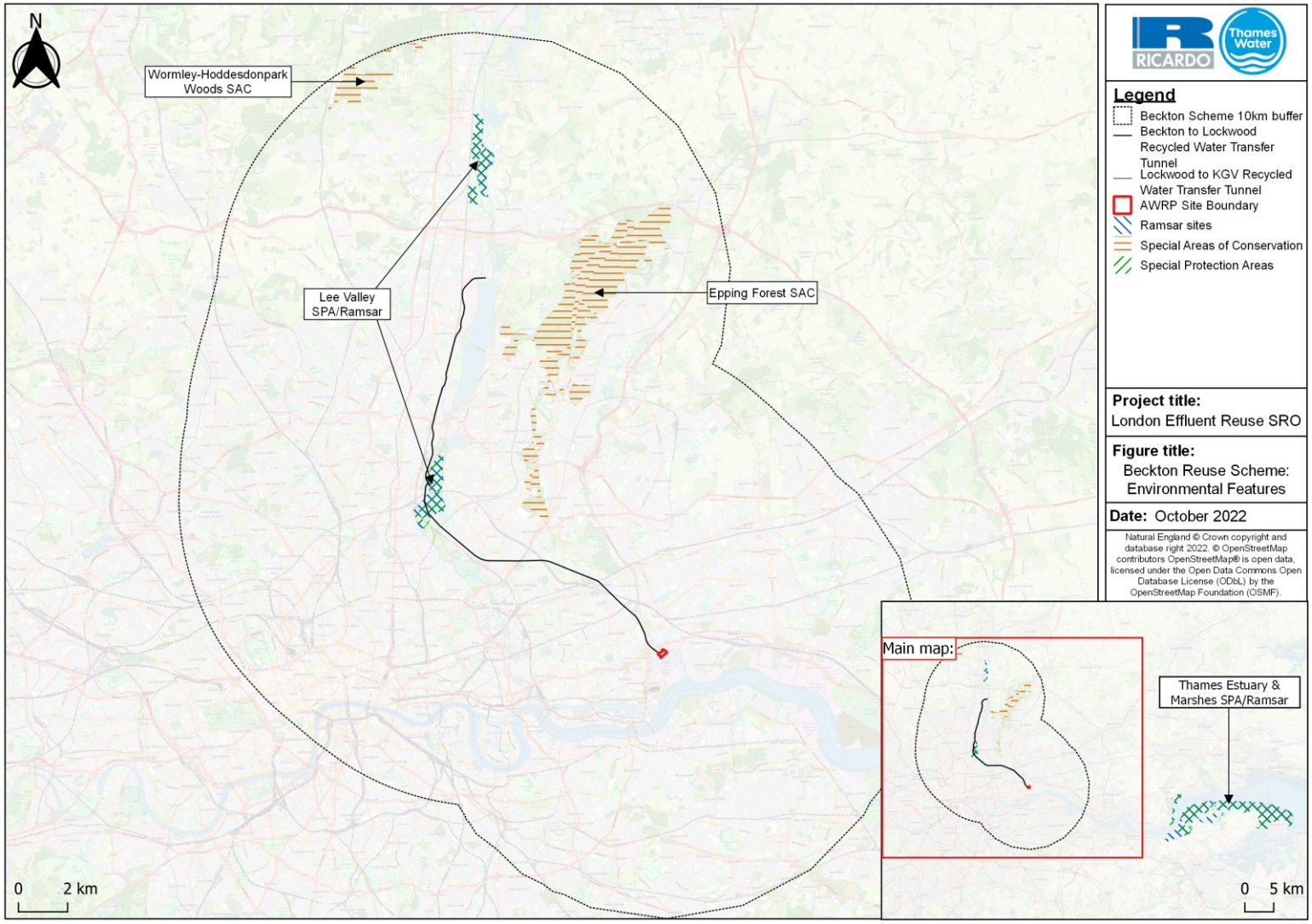
A risk of LSE associated with construction of Teddington DRA alone was identified for qualifying features of Richmond Park SAC. No low level residual effects were identified from Teddington DRA scheme that could lead to likely significant effects in-combination with other plans and projects.

[31] Special Areas of Conservation (SACs) are strictly protected sites designated under the EC Habitats Directive. Article 3 of the Habitats Directive requires the establishment of a European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). www.jncc.org.uk

[32] Special Protection Areas (SPAs) are strictly protected sites classified in accordance with Article 4 of the EC Directive on the conservation of wild birds (79/409/EEC), also known as the Birds Directive, which came into force in April 1979. They are classified for rare and vulnerable birds, listed in Annex I to the Birds Directive, and for regularly occurring migratory species. www.jncc.org.uk

[33] Ramsar sites are wetlands of international importance designated under the Ramsar Convention

Figure 3-1 Beckton water recycling scheme conveyance in relation to European sites within 10km and downstream[34]



[34] Which are considered to be functionally linked.

Figure 3-2 Mogden water recycling scheme conveyance in relation to European sites within 10 km buffer

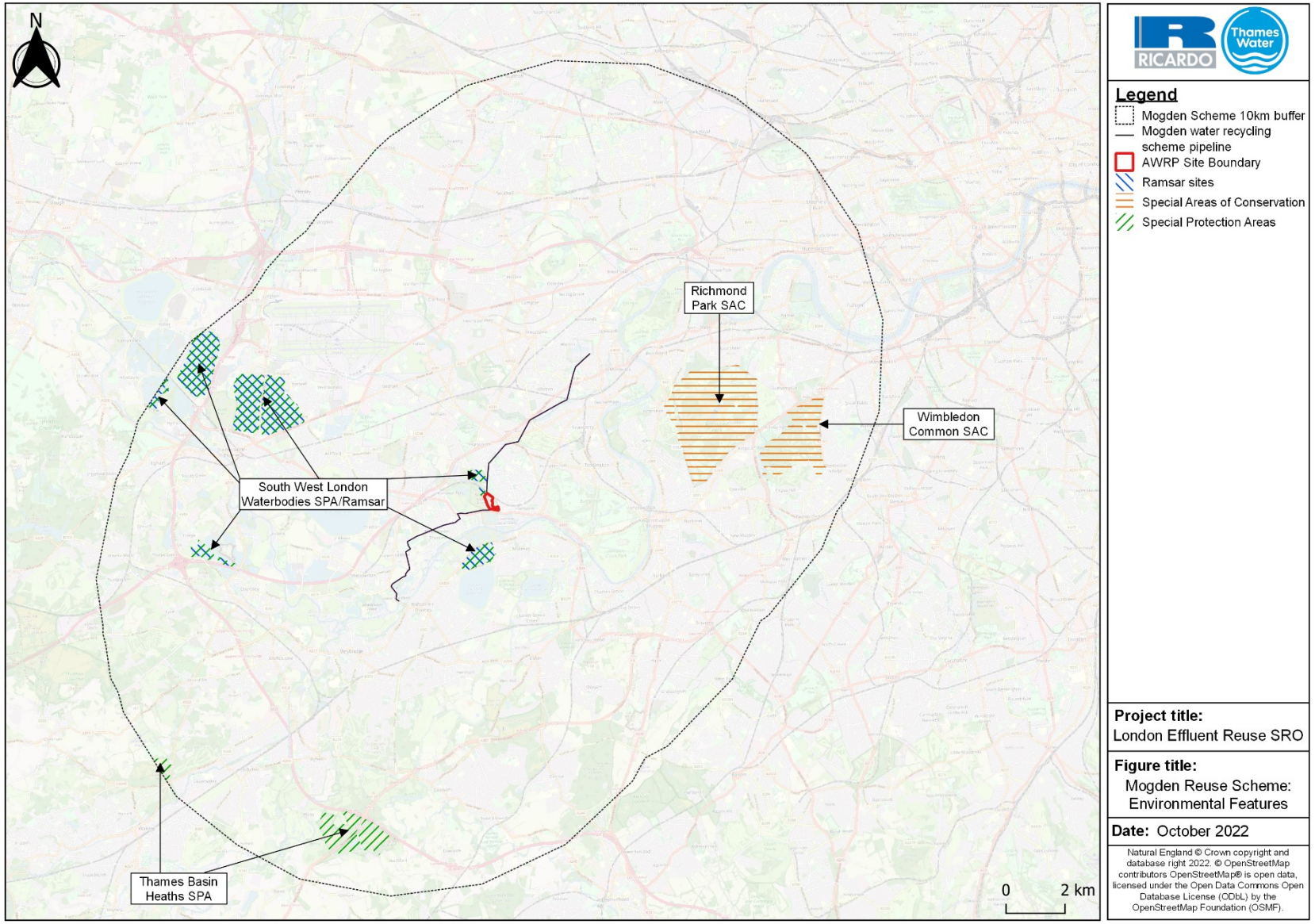
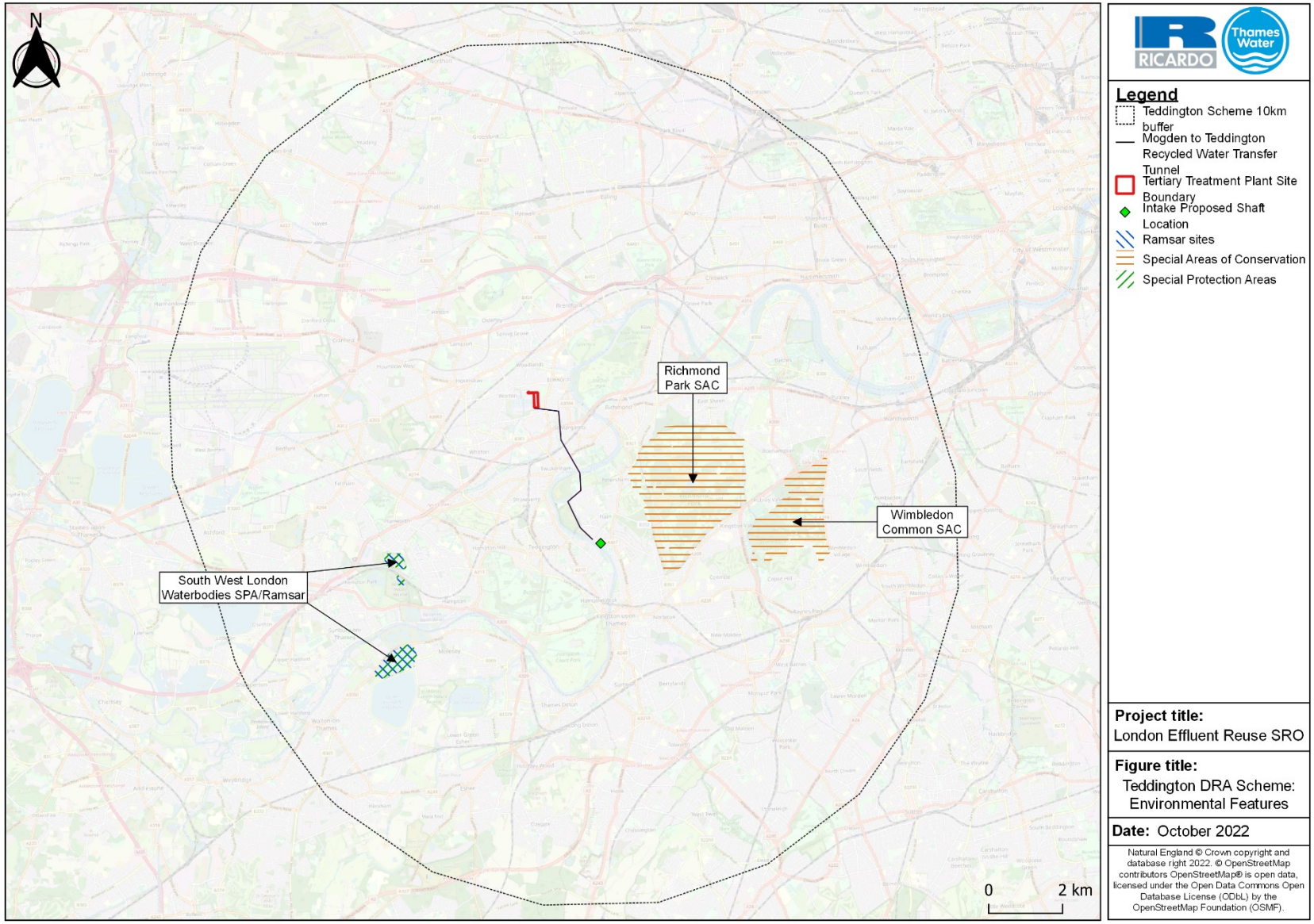


Figure 3-3 Teddington Direct River Abstraction scheme conveyance and European sites within 10 km buffer.



3.2 SUMMARY OF STAGE 1 SCREENING

A summary of the outcomes of the *informal* Stage 1 Screening for London Effluent Reuse schemes is presented below in Table 3-1, with detailed assessments provided in Appendix 2 . The likely significant effect of an identified impact pathway has been considered in the absence of appropriate mitigation measures. As an *informal* Stage 1 Screening, the outcomes of future assessments may be subject to change based on amendments to scheme design at Gate 3.

Table 3-1 Summary of the outcomes of *informal* Stage 1 Screening of the London Effluent Reuse schemes, indicating which require *informal* Stage 2 Appropriate Assessment due to potential Likely Significant Effects on European sites.

London effluent reuse scheme	Qualifying features	Risk of Likely Significant Effect?	Impact pathway
Lee Valley SPA			
Beckton water recycling scheme	Great bittern *Botaurus stellaris*	Yes	Construction – Noise disturbance. Construction – Physical barriers to flight paths. Operation – No impact pathways identified.
	Northern shoveler *Spatula clypeata*	Yes	Construction – Noise disturbance. Construction – Loss of supporting terrestrial habitat. Construction – Physical barriers to flight paths. Operation – No impact pathways identified.
	Gadwall *Anas strepera*		
Lee Valley Ramsar[35]			
Beckton water recycling scheme	Whorled water-milfoil *Myriophyllum verticillatum*	Yes	Construction – Air quality and dust emissions. Operation – No impact pathways identified.
	Waterboatman *Micronecta minutissima*	Yes	Construction – Air quality and dust emissions. Operation – No impact pathways identified.
Thames Estuary and Marshes SPA			
Beckton water recycling scheme	Avocet *Recurvirostra avosetta*	Yes	Construction – Noise disturbance. Operation – Change in hydrological regime and water quality in Barking Creek (potential functionally linked habitat).
	Black-tailed godwit *Limosa limosa*		
	Dunlin *Calidris alpina*		
	Grey plover *Pluvialis squatarola*		
	Hen harrier *Circus cyaneus*		
	Red knot *Calidris canutus*		
	Redshank *Tringa totanus*		
	Ringed plover *Charadrius hiaticula*		
	Waterfowl assemblage		

[35] Northern shoveler and gadwall considered as part of the Lee Valley SPA.

London effluent reuse scheme	Qualifying features	Risk of Likely Significant Effect?	Impact pathway
Thames Estuary and Marshes Ramsar[36]			
Beckton water recycling scheme	Ramsar criterion 2 – wetland plant and invertebrate assemblages	Yes	Construction – No impact pathways. Operation – No impact pathways identified.
	Ramsar criterion 5 – waterbird assemblage	Yes	Construction – Noise disturbance. Construction – Air quality and dust emissions. Operation – Change in hydrological regime and water quality in Barking Creek (potential functionally linked habitat).
Epping Forest SAC			
Beckton water recycling scheme	Atlantic acidophilous beech forests	No	N/A
	Atlantic wet heaths	No	N/A
	European dry heaths	No	N/A
	Stag beetle *Lucanus cervus*	No	N/A
South West London Waterbodies SPA and Ramsar			
Mogden water recycling scheme	Northern shoveler	Yes	Construction – Noise disturbance. Construction – Air quality and dust emissions. Operation – No impact pathways identified.
	Gadwall		
Teddington DRA scheme	Northern shoveler	No	N/A
	Gadwall	No	N/A
Richmond Park SAC			
Mogden water recycling scheme	Stag beetle	No	N/A
Teddington DRA scheme	Stag beetle	Yes	Construction – Loss of functionally linked habitat loss, direct mortality and disturbance to off-site populations. Construction – Air quality and dust emissions. Operation – No impact pathways identified.
Thames Basin Heaths SPA			
Mogden water recycling scheme	Dartford warbler *Sylvia undata*	No	N/A
	Nightjar *Caprimulgus europaeus*	No	N/A
	Woodlark *Lullula arborea*	No	N/A
Thursley, Ash, Pirbright and Chobham SAC			

[36] Black-tailed godwit, dunlin, grey plover, red knot, redshank and ringed plover considered as part of the Thames Estuary and Marshes SPA.

London effluent reuse scheme	Qualifying features	Risk of Likely Significant Effect?	Impact pathway
Mogden water recycling scheme	Northern Atlantic wet heaths with *Erica tetralix*	No	N/A
	European dry heaths	No	N/A
	Depression on peat substrates of the Rhynchosporion	No	N/A
Wimbledon Common SAC			
Mogden water recycling scheme	Northern Atlantic wet heaths with *Erica tetralix*	No	N/A
	European dry heaths	No	N/A
	Stag beetle	No	N/A
Teddington DRA scheme	Northern Atlantic wet heaths with *Erica tetralix*	No	N/A
	European dry heaths	No	N/A
	Stag beetle	No	N/A

4. *INFORMAL* STAGE 2 APPROPRIATE ASSESSMENTS

4.1 SCOPE OF THE *INFORMAL* APPROPRIATE ASSESSMENT

The *informal* Stage 1 Screening for LSE (see Section 3) has identified the requirement for *informal* Stage 2 Appropriate Assessments of a number of European sites. The scope of the *informal* Stage 2 Appropriate Assessments is summarised in Table 4-1. The assessment has been undertaken on a precautionary basis. As an *informal* Stage 2 Appropriate Assessment, the outcomes of future assessments may be subject to change based on amendments to scheme design at Gate 3.

Table 4-1 Scope of the *informal* Stage 2 Appropriate Assessments.

Scheme	Phase	Relevant European site	Scope of *informal* Stage 2 Appropriate Assessment
Beckton water recycling	Construction	Lee Valley SPA and Ramsar	• The assessment needs to consider the potential adverse effects from the direct loss of neutral grassland and scattered scrub within the boundary of the Lee Valley SPA and Ramsar site. • The assessment needs to consider the potential adverse effects of construction infrastructure creating physical barriers to flight between feeding and roosting sites for qualifying bird species of the Lee Valley SPA and Ramsar site at Lockwood Reservoir (shafts 5 and 6). • The assessment needs to consider the potential adverse effects of noise disturbance on qualifying birds of the Lee Valley SPA and Ramsar site during construction works at Coppermills (Compound/ Shaft 5), Lockwood (Compound/ Shaft 6, primary and secondary) and Compound/ Shaft 10 at the discharge location. • The assessment needs to consider potential adverse effects of pollution via dust and traffic emissions in supporting habitat of qualifying features of the Lee Valley SPA and Ramsar site.
		Thames Estuary and Marshes SPA and Ramsar	• The assessment needs to consider the potential adverse effects of noise disturbance on qualifying birds of the Thames Estuary and Marshes SPA and Ramsar site, that could be present at functionally linked habitat associated with the Barking Creek and the Thames Estuary. • The assessment needs to consider potential adverse effects of pollution via dust and traffic emissions in supporting habitat of qualifying features of the Thames Estuary and Marshes SPA and Ramsar site.
	Operation	Thames Estuary and Marshes SPA and Ramsar	• The assessment needs to consider the potential adverse effects of changes in hydrological regime at the existing Beckton STW outfall and changes in water quality as a result of hypersaline wastewater discharge into Barking Creek and wider Thames Estuary. This is due to the presence of potential functionally linked habitat (saltmarsh and mudflat priority habitat) to qualifying birds of the Thames Estuary and Marshes SPA and Ramsar site.
Mogden water recycling	Construction	South West London Waterbodies SPA and Ramsar	• The assessment needs to consider the potential adverse effects of noise disturbance on qualifying birds of the Lee Valley SPA and Ramsar site during

Scheme	Phase	Relevant European site	Scope of *informal* Stage 2 Appropriate Assessment
			construction works at the AWRP near Kempton WTW, Shaft/ Compound 9, 10, 11, 13 and 14. • The assessment needs to consider potential adverse effects of pollution via dust and traffic emissions in supporting habitat of qualifying birds of South West London Waterbodies SPA and Ramsar site.
Teddington DRA	Construction	Richmond Park SAC	• The assessment needs to consider the potential adverse effects of loss of functionally linked habitat, direct mortality and disturbance of stag beetle *Lucanus cervus* (if present) offsite at Shaft/ Compound 7 and the intake site on the River Thames. • The assessment needs to consider potential adverse effects of dust and traffic emissions on supporting/ functionally linked habitat for stag beetle.

4.2 BECKTON WATER RECYCLING SCHEME

4.2.1 Baseline

4.2.1.1 Lee Valley SPA

The Lee Valley SPA (central location: Latitude 51.58083333, Longitude -0.049444444)[37] covers 4.51km² and overlaps the following SSSI: Amwell Quarry SSSI, Rye Meads SSSI, Turnford and Cheshunt SSSI and Walthamstow Reservoirs SSSI. The SPA consists of a series of artificial water supply reservoirs, sewage treatment lagoons and former gravel pits distributed across Essex, Hertfordshire, London Borough of Haringey and London Borough of Waltham Forest[38]. The SPA consists of a variety of habitats including shallow water basins, marshes, marginal reedbeds, wooded islands, wet meadows, grassland and scrub. The Lee Valley SPA is designated for wintering great bittern *Botaurus stellaris*, northern shoveler *Anas clypeata* and gadwall *Anas strepera*.

Great bittern

Great bittern have a broad distribution in northern Europe, but in Scandinavia, UK and central/southern Europe their distribution remains patchy. They are listed as 'least concern' in the IUCN Red List of Threatened Species. In the UK, their winter population is increasing, with 795 individuals recorded in 2017 – 2018[39]. They only occupy extensive *Phragmites* reedbed habitat, and therefore, these sites are vital for feeding, breeding and resting. In the Lee Valley SPA (and Ramsar site), great bittern are mostly recorded in the Turnford and Cheshunt Pits SSSI and sporadically at Walthamstow Reservoirs SSSI. Their diet largely consists of fish, amphibians and terrestrial invertebrates.

Northern shoveler

The northern shoveler has a broad distribution, occupying parts of Scandinavia, Europe, UK and Northern Africa[78]. In the UK, wintering populations of northern shoveler are increasing with approximately 20,000 individuals recorded from 2012 – 2017[39]. Currently the species is listed as 'least concern' in the IUCN Red List of Threatened Species but global population estimates do indicate northern shoveler populations may be in decline[78]. The Lee Valley SPA (and Ramsar site) supports an estimated 1% of the north-west/central European population of northern shoveler (based on 5-year peak mean 1993/94 – 1997/98)[40]. In winter, they are distributed across the SPA, using the shallow waterbodies present in the marshes, flooded pastures, lakes

[37] JNCC (2016). Natura 2000 – Standard Data Form, Lee Valley SPA. Natura 2000 database, 1 – 10.

[38] Natural England (2018). European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features. Lee Valley Special Protection Area. Natura 2000 database, 1 – 23.

[39] Robinson, R. A (2005). BirdFacts: profiles of birds occurring in Britain and Ireland. BTO, Thetford. Accessed from: https://app.bto.org/birdfacts/results/bob1940.htm.

[40] English Nature (2000). EC Directive 79/409 on the Conservation of Wild Birds: Special Protection Areas (SPA). Lee Valley, Classification citation, pg 1.

and reservoirs[40]. They use inland eutrophic waterbodies with a mixture of rich vegetation and sufficient open water with shallow margins where they are able to feed on aquatic invertebrates and zooplankton[41].

Gadwall

Gadwall have a broad distribution in north, central and eastern Europe, but in Scandinavia, UK and southern Europe the distribution remains patchy. They are listed as 'least concern' in the IUCN Red List of Threatened Species[42]. In the UK, their wintering population trend is slowly increasing with approximately 31,000 individuals recorded from 2012 - 2017[43], occupying both inland and coastal wetlands. The Lee Valley SPA supports an estimated 1.5% of the north-west European population of gadwall (based on 5-year peak mean 1993/94 – 1997/98)[44]. Of the artificial habitats present in the Lee Valley SPA, gadwall show preference to the gravel pits and reservoirs, particularly during the winter as they feed on seeds and foliage of aquatic vegetation44. Gadwall use both inland eutrophic waterbodies and coastal bays with shallow margins and a mixture of rich vegetation (reedbeds and wooded inlets) and a sufficient area of open water[45]. Their diet is primarily aquatic vegetation including macrophytes and filamentous algae.

4.2.1.2 Lee Valley Ramsar

The Lee Valley Ramsar site (central location: Latitude 51.5808333, Longitude -0.0494444)[46] covers 4.48km². Like the Lee Valley SPA, the Ramsar site comprises of four SSSIs that cover 24 km of the Valley and includes water supply reservoirs, sewage treatment lagoons and former gravel pits. The combination of waterbodies supports both international and national wintering bird assemblages including northern shoveler and gadwall. The site is also designated due to the presence of a nationally scarce plant species (whorled water-milfoil, *Myriophyllum verticillatum*) and a rare invertebrate (waterboatman, *Micronecta minutissima*)[46]. For descriptions of northern shoveler and gadwall in the context of the Lee Valley designated sites, see Section 4.2.1.1 above.

Whorled water-milfoil

Whorled water-milfoil is an aquatic perennial that colonises slow flowing, calcareous waterbodies including lakes, streams, canals and ditches[47]. In the UK, the plant's distribution is concentrated in eastern and southern England with no records in Scotland and <10 records in Wales. It is larger than spiked water-milfoil *Myriophyllum spicatum* and alternate water-milfoil *M. alterniflorum*[48]. The submerged plant grows in water depths from 30 – 100cm over both peaty and inorganic substrates, flowers in July – August and effectively helps oxygenate waterbodies[49]. In the Lee Valley Ramsar site, whorled water-milfoil both supports invertebrate assemblages and waterfowl as foraging sites.

Waterboatman

Waterboatman is a nationally rare aquatic invertebrate in the UK and currently the species is listed as of least concern in the IUCN Red List of Threatened Species. There are few records of this species in the UK, with most individuals observed in southern England and East Anglia. The northern limit of this species is around Northumberland[50].

4.2.1.3 Thames Estuary and Marshes SPA

The Thames Estuary and Marshes SPA (central location: Latitude 51.4855556, Longitude 0.5963888)[51] covers 48.39km². The SPA comprises of two SSSIs which include the Mucking Flats and Marshes SSSI and South

[41] Svensson, L (2009). Collins Bird Guide, 2nd edition. Harper Collins Publishers Ltd. 1 – 429.

[42] Natural England (2018). European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features. South West London Waterbodies Special Protection Area. Natura 2000 database, 1 – 20.

[43] Robinson, R. A (2005). BirdFacts: profiles of birds occurring in Britain and Ireland. BTO, Thetford. Accessed from: https://app.bto.org/birdfacts/results/bob1940.htm.

[44] Natural England (2018). European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features. Lee Valley Special Protection Area. Natura 2000 database, 1 – 23.

[45] Svensson, L (2009). Collins Bird Guide, 2nd edition. Harper Collins Publishers Ltd. 1 – 429.

[46] JNCC (2008). Information Sheet on Ramsar Wetlands (RIS), Lee Valley. JNCC. Version 3.0, 1-9.

[47] Biological Records Centre (2008). Online Atlas of the British and Irish Flora, *Myriophyllum verticillatum.* Accessed from: Myriophyllum verticillatum | Online Atlas of the British and Irish Flora (brc.ac.uk).

[48] Rose. F (2006). The Wild Flower Key. Frederick Warne, 1 – 563.

[49] Plants for ponds (2021). Whorled Water Milfoil. Accessed from: Whorled Water Milfoil-(Myriophyllum verticillatum) - Plants for Ponds.

[50] Natural England (2015). A review of the Hemiptera of Great Britain: The Aquatic and Semi-aquatic Bugs. Natural England Commissioned Report NECR188, 1 – 66.

[51] JNCC (2006). Thames Estuary and Marshes, Standard Natura 2000 Data Form. Version 1.1, 1 -3.

Thames Estuary and Marshes SSSI. The SPA contains the largest expanse of grazing saltmarsh in Kent, which provide important feeding and roosting grounds for a diversity of waterfowl species. The grazing saltmarshes consists of a complex array of brackish and freshwater ditches and areas of open water[52]. The large areas of intertidal mudflats are submerged at high tide and exposed during low tide, providing important feeding habitat for waterfowl assemblages. The estuary also provides extensive roosting sites for large populations of waterbirds and is vital supporting habitat during the winter for avocet, black-tailed godwit *Limosa limosa*, dunlin *Calidris alpina*, grey plover *Pluvialis squatarola*, hen harrier *Circus cyaneus*[53], red knot *Calidris canutus*, common redshank *Tringa totanus* and common ringed plover *Charadrius hiaticula.*

Avocet

Avocet *Recurvirostra avosetta* populations are distributed from southern Scandinavia to northern Africa; wintering in the Mediterranean and northern Africa. In the UK, there are breeding, resident and migratory populations of avocet. They have a scattered distribution, with breeding populations largely located on the east of England and wintering populations along the coast of south Wales, southern and eastern coasts of England and a couple of key sites on the eastern coast of Scotland[55]. The Thames Estuary and Marshes SPA has previously supported 283 individuals during the winter, (5-year peak mean 1993/94 – 1997/98) which accounted for 28.3% of the British population of pied avocet. Avocet occurs in nationally important numbers within the Thames Estuary European Marine Site. They also use flooded mineral workings and areas of grazing marsh within the SPA but above the point of highest astronomical tide and therefore outside the European marine site boundary, particularly when displaced from the mudflats at high tide[54].

Black-tailed godwit

Black-tailed godwit have a broad distribution from Iceland to northern Africa. They breed on extensive wet meadows, grassy marshes and boggy moorland and are frequent mainly in estuaries, saltings, coastal mudflats and lagoons on passage and during the winter[55]. In the UK, there are breeding populations that are mainly resident, with a small number of migrants (estimated ≤100 pairs) and scarce or local winter and passage visitors (estimated >100 pairs)[55]. The Thames Estuary and Marshes SPA has previously supported 1,599 individuals during the winter (5-year peak mean 1993/94 – 1997/98) which accounted for 2.4% of the black-tailed godwit population present in Iceland[54]. Mudflats within the SPA are a rich source of invertebrates and provide the main feeding ground for black-tailed godwit, which occur in internationally important numbers.

Dunlin

Dunlin have a broad distribution from Iceland to northern Africa. They breed on low or high ground, in wet short-grass or tundra habitats, and during the winter occupy a variety of marshland and coastal habitats[55]. In the UK, dunlin has breeding populations that are largely resident, but a small number are migratory (scarce or local; >100 pairs), passage and wintering populations that are abundant (>100,000 pairs)[55]. They are recorded in high numbers on tidal flats or accumulations of seaweed on lower shores where they feed on polychaetes, crustaceans and molluscs. The Thames Estuary and Marshes SPA has previously supported 29,646 individuals during the winter (5-year peak mean 1993/94 – 1997/98) which accounted for 2.1% of dunlin populations present in northern Siberia, Europe and West Africa[56]. Mudflats within the SPA are a rich source of invertebrates and provide the main feeding ground for dunlin, which occur in internationally important numbers.

Grey plover

Grey plover has a broad distribution, breeding in the high Arctic on tundra habitats and migrating south for the winter to parts of western Europe and western Africa. During the autumn migration, grey plover are found in small numbers on the coastline using shingle banks to feed and roost, and in the winter, they tend to use tidal flats and adjacent freshwater pools. In the UK, they are fairly abundant passage and winter visitors (estimated >10,000 pairs)[57]. The Thames Estuary and Marshes SPA has previously supported 2,593 individuals during

[52] Natural England (2021). Thames Estuary and Marshes SPA. Designated Sites View. Accessed from: https://designatedsites.naturalengland.org.uk/SiteGeneralDetail.aspx?SiteCode=UK9012021&SiteName=THAMES ESTUARY &countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

[53] Screened out of Stage 2 Appropriate Assessment based on distribution.

[54] English Nature (2001). *Thames Estuary, European marine site*. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994), 1-59.

[55] Svensson, L., Mullarney, K., & Zetterström, D (2009). *Collins Bird Guide, 2nd Edition.* Harper Collins Publishers Ltd. 1 – 445.

[56] English Nature (2001). *Thames Estuary, European marine site*. English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994), 1-59.

the winter (5-year peak mean 1993/94 – 1997/98), which accounted for 1.7% of the grey plover populations present in the eastern Atlantic[56].

Hen harrier

Hen harriers have a broad distribution with populations present in northern Scandinavia to northern Africa. They breed on bogs in open taiga, marshes, shallow lakes with a cover of vegetation and heathland. In the UK, there are breeding populations that are mainly resident with a small number of migrants (scarce or local; >100 pairs)[57]. The Thames Estuary and Marshes SPA has previously supported 7 individuals (5-year peak mean 1993/94 – 1997/98), which accounted for 1% of the British population of hen harrier[56].

Red knot

Red knot has a broad distribution, breeding in the high Arctic and migrating as far as south Africa for the winter. In the UK, red knot are very abundant or abundant passage and winter visitors (up to >1 million pairs)[57]. The Thames Estuary and Marshes SPA has previously supported 4,848 individuals during the winter (5-year peak mean 1993/94 – 1997/98) which accounted for 1.4% of the red knot populations present in north-west Europe[56]. Mudflats within the SPA are a rich source of invertebrates and provide the main feeding ground for red knot, which occur in internationally important numbers.

Common redshank

Common redshank has a broad distribution from Iceland to northern Africa. They breed inland and on coastal marshes, wet meadows and moorland, and during the winter are largely found within coastal habitats[57]. In the UK, common redshank has breeding populations that are mainly resident. A small number are migratory and fairly abundant (>10,000 pairs), and passage and winter visitors are abundant (>100,000 pairs)55. The Thames Estuary and Marshes SPA has previously supported 3,251 individuals during the winter (5-year peak mean 1993/94 – 1997/98), which accounted for 2.2% of the common redshank populations in the eastern Atlantic[56].

Common ringed plover

Common ringed plover has a broad distribution from Iceland, northern Scandinavia to northern Africa. During the wintering period, they occupy inland water margins, estuaries and tidal flats, and in the breeding season, they show preference for gravel and sand habitats[57]. In the UK, ringed plover has breeding populations that are mainly resident, but a small number are migratory from Iceland (scarce or local; >100 pairs), passage visitors and winter visitors[57]. They often feed on benthic invertebrates within rotting seaweed that accumulates along strandlines. The Thames Estuary and Marshes SPA has previously supported 1,324 individuals during the winter (5-year peak mean 1993/94 – 1997/98), which accounted for 2.6% of the common ringed plover populations in Europe and north Africa[56].

Waterfowl assemblage

The Thames Estuary and Marshes SPA has previously supported 75,019 individuals (5-year peak mean 1993/94 – 1997/8) of wintering waterfowl species. This includes both internationally and nationally important migratory qualifying bird species of this designated site.

4.2.1.4 Thames Estuary and Marshes Ramsar

The Thames Estuary and Marshes Ramsar site (central location: Latitude 51.4855556, Longitude 0.5963888)[58] covers 55.89km². Like the SPA, two SSSI sites: Mucking Flats and Marshes SSSI and South Thames Estuary and Marshes SSSI underlay the Ramsar site. The intertidal mudflats consist of fine and silty sediment, although sandy in places. The saltmarsh shows a transition from pioneer communities containing seagrass (*Zostera* species) in the lower sections to sea purslane *Atriplex portulacoides* in the mid-upper marsh. The grazing marsh is mesotrophic and generally species-poor, although it does contain scattered rarities; mostly annuals characteristic of bare ground. Where the grassland is seasonally inundated by salt water, the plant communities are intermediate between those of mesotrophic grassland and those of saltmarsh. These variable conditions of brackish and freshwater have created a floral mosaic of successional stages resulting from periodic clearance of drainage channels. The most abundant emergent vegetation includes common reed *Phragmites communis* and sea clubrush *Bolboschoenus maritimus*. The saline lagoons support diverse

[57] Svensson, L., Mullarney, K., & Zetterström, D (2009). *Collins Bird Guide, 2nd Edition.* Harper Collins Publishers Ltd. 1 – 445.
[58] JNCC (2006). *Thames Estuary and Marshes, Standard Natura 2000 Data Form*. Version 1.1, 1-3.

invertebrate assemblages including molluscs and crustaceans and flora including *Ulva* and *Chaetomopha*[59]. Note that qualifying species that overlap with the SPA are discussed in section 4.2.1.2.

Wetland plants and invertebrate assemblages

The Thames Estuary and Marshes Ramsar site supports more than 20 British Red Data Book invertebrates and populations of the GB Red Book endangered least lettuce *Lactuca saligna*, as well as the vulnerable slender hare's-ear *Bupleurum tenuissimum*, divided sedge *Carex divisa*, sea barley *Hordeum marinum*, Borrer's saltmarsh-grass *Puccinellia fasciculata*, and dwarf eelgrass *Zostera noltei*[59].

4.2.1.5 WeBS core count data

4.2.1.5.1 Lee Valley SPA and Ramsar

WeBS core count survey data was requested where impact pathways have been identified at reservoirs associated with the Lee Valley SPA and Ramsar site. The data received is displayed in Table 4-2 - Table 4-4. The sites include King George V Reservoirs (24152), Banbury Reservoir (24108), Walthamstow Reservoirs excluding Banbury (24107) and William Girling Reservoir (24151). Survey data was provided of the peak counts in autumn and winter during a five year monitoring period: autumn is September – October and winter is November – March. Autumn peak counts for Banbury Reservoir are not displayed as no records of gadwall or northern shoveler were received.

No data records were received for great bittern in relation to the Lee Valley SPA at King George V Reservoirs, Banbury Reservoir, Walthamstow Reservoirs excluding Banbury and William Girling Reservoir. There are data gaps during years when surveys were not completed, which are recorded as no counts (N/C). Survey data from 2021 was not available at the time of data requests being undertaken.

Table 4-2 Autumn peak counts of qualifying species of the Lee Valley SPA and Ramsar site: northern shoveler at King George V Reservoir, Walthamstow Reservoirs excluding Banbury and William Girling Reservoir from 2015 – 2020.

WeBS site	Species	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Mean of peaks
King George V Reservoir	Gadwall *Anas strepera*	12 (OCT)	26 (SEP)	21 (OCT)	17 (OCT)	17 (OCT)	19
	Northern shoveler *Anas clypeata*	46 (OCT)	138 (SEP)	163 (OCT)	51 (OCT)	120 (SEP)	104
Walthamstow Reservoirs excluding Banbury	Gadwall	7 (JUL)	15 (SEP)	27 (OCT)	8 (JUL)	8 (SEP)	13
	Northern shoveler	71 (OCT)	36 (SEP)	107 (OCT)	3 (JUL)	21 (OCT)	48
William Girling Reservoir	Gadwall	20 (OCT)	N/C	0	25 (OCT)	9 (SEP)	18
	Northern shoveler	6 (OCT)	N/C	0	0	1 (SEP)	2

[59] JNCC (2007). *Thames Estuary and Marshes Information Sheet on Ramsar Wetlands*. JNCC, Version 3.0, 1-8.

Table 4-3 Winter peak counts of qualifying species of the Lee Valley SPA and Ramsar site: gadwall and northern shoveler at King George V Reservoir, Walthamstow Reservoirs excluding Banbury and William Girling Reservoir from 2015 – 2020.

WeBS site	Species	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Mean of peaks
King George V Reservoir	Gadwall *Anas strepera*	33 (MAR)	0	18 (MAR)	85 (JAN)	32 (MAR)	34
	Northern shoveler *Anas clypeata*	8 (DEC)	0	14 (DEC)	25 (NOV)	11 (NOV)	12
Walthamstow Reservoir excluding Banbury	Gadwall	15 (JAN)	21 (MAR)	41 (JAN)	43 (JAN)	45 (DEC)	33
	Northern shoveler	19 (JAN)	39 (NOV)	15 (NOV)	75 (NOV)	4 (DEC)	30
William Girling Reservoir	Gadwall	42 (MAR)	6 (FEB)	64 (DEC)	53 (JAN)	35 (DEC)	40
	Northern shoveler	2 (DEC)	0	0	4 (JAN)	0	2

Table 4-4 Winter peak counts of gadwall and northern shoveler at Banbury Reservoir from 2009 – 2014.

WeBS site	Species	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	Mean of peaks
Banbury Reservoir	Gadwall *Anas strepera*	N/C	N/C	N/C	3 (FEB)	0	2
	Northern shoveler *Anas clypeata*	N/C	N/C	N/C	N/C	0	0

4.2.1.5.2 Wanstead Flats: functionally linked habitat

WeBS core count survey data was requested for Wanstead Flats (24077) where impact pathways had been identified for potential functionally linked habitat to the Lee Valley SPA and Ramsar site (specifically three ponds <500 m from Shaft 2 and Shaft 3). WeBS core count data was also requested for the River Thames – Barking (24903) where impact pathways have been identified for potential functionally linked habitat for qualifying features of the Thames Estuary and Marshes SPA and Ramsar site. The data received is displayed in Table 4-5 and Table 4-6. Survey data was provided of the peak counts in autumn and winter during a five year monitoring period; autumn is September – October and winter is November – March. There are data gaps during years when surveys were not completed, which are recorded as no counts (N/C).

No data records were received for great bittern in relation to the Lee Valley SPA at Wanstead Flats. There were also no records received for grey plover, hen harrier, knot, ringed plover, Bewick's swan, golden plover, pintail, tufted duck or pochard during autumn and winter peak counts at River Thames – Barking. No records of avocet were received in autumn. However, a mean peak count of 3 was recorded during the winter from 2016 – 2021. In addition, no ruff *Calidris pugnax* records were received for the winter period. However, a mean peak count of 1 individual was recorded during the autumn from 2016 – 2021. WeBS core count was requested for Wanstead Flats (24077) where impact pathways had been identified for potential functionally linked habitat to the Lee Valley SPA and Ramsar site (specifically three ponds <500 m from Shaft 2 and Shaft 3).

Table 4-5 Autumn peak counts of qualifying species of the Lee Valley Special Protection Area (SPA) and Ramsar at Wanstead Flats and the Thames Estuary and Marshes SPA and Ramsar site at River Thames – Barking.

WeBS site	Species	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	Mean of peaks
Wanstead Flats	Gadwall *Anas strepera*	N/C	8 (SEP)	N/C	N/C	N/C	8
	Northern shoveler *Anas clypeata*	N/C	20 (OCT)	N/C	N/C	N/C	20
	Black-tailed godwit *Limosa limosa*	N/C	N/C	184 (OCT)	137 (OCT)	187 (OCT)	169
	Dunlin *Calidris alpina*	N/C	N/C	31 (OCT)	2 (OCT)	1 (OCT)	11
	Redshank *Tringa totanus*	N/C	N/C	207 (OCT)	129 (OCT)	202 (OCT)	179
	Ruff* *Philomachus pugnax*	N/C	N/C	0	0	2 (SEP)	1
	Shelduck* *Tadorna tadorna*	N/C	N/C	159 (JUL)	137 (OCT)	158 (SEP)	151
	Teal* *Anas crecca*	N/C	N/C	681 (OCT)	692 (SEP)	505 (SEP)	626
	Pintail* *Anas acuta*	N/C	N/C	0	0	0	0
	Gadwall*	N/C	N/C	26 (AUG)	41 (OCT)	42 (OCT)	36
	Shoveler*	N/C	N/C	7 (OCT)	0	14 (OCT)	7

*Species under water assemblage qualifying feature

Table 4-6 Winter peak counts of qualifying species of the Lee Valley Special Protection Area (SPA) and Ramsar at Wanstead Flats and the Thames Estuary and Marshes SPA and Ramsar site at River Thames – Barking.

WeBS site	Species	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	Mean of peaks
Wanstead Flats	Gadwall *Anas strepera*	9 (DEC)	2 (DEC)	N/C	N/C	10 (NOV)	7
	Northern shoveler *Anas clypeata*	22 (DEC)	9 (NOV)	N/C	N/C	17 (NOV)	16

*Species under water assemblage qualifying feature

4.2.1.5.3 Thames Estuary and Marshes SPA and Ramsar: functionally linked habitat

WeBS core count survey data was requested for the River Thames – Barking (24903) where impact pathways have been identified for potential functionally linked habitat for qualifying features of the Thames Estuary and Marshes SPA and Ramsar site. A total of 32 species have been recorded at River Thames – Barking from 2016 – 2021 including waterfowl, waders, gulls and terns. Of these species, seven are classed as 'notable'. These are black-tailed godwit, brent goose *Branta bernicla*, curlew *Numenius arquata*, dunlin, herring gull *Larus argentatus*, lapwing *Vanellus vanellus* and ruff.

Table 4-7 Winter peak counts of qualifying species of the Thames Estuary and Marshes SPA and Ramsar site at River Thames – Barking.

WeBS site	Species	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	Mean of peaks
River Thames – Barking	Avocet *Recurvirostra avosetta*	N/C	(6) (DEC)	3 (FEB)	1 (DEC)	N/C	3
	Black-tailed godwit *Limosa limosa*	N/C	17 (FEB)	120 (JAN)	1 (NOV)	N/C	46
	Dunlin *Calidris alpina*	N/C	208 (FEB)	669 (JAN)	301 (NOV)	N/C	393
	Redshank *Tringa totanus*	N/C	38 (FEB)	181 (NOV)	81 (DEC)	N/C	100
	Shelduck* *Tadorna tadorna*	N/C	(98) (DEC)	194 (FEB)	120 (DEC)	N/C	157
	Teal* *Anas crecca*	N/C	356 (MAR)	562 (FEB)	551 (DEC)	N/C	490
	Gadwall*	N/C	51 (FEB)	66 (DEC)	96 (NOV)	N/C	71
	Shoveler*	N/C	69 (JAN)	56 (JAN)	45 (JAN)	N/C	57

*Species under water assemblage qualifying feature

4.2.2 Assessment of terrestrial habitat loss

4.2.2.1 Construction of Shaft 6 (primary and secondary shafts) at Lockwood

The temporary construction compounds for the primary and secondary shafts will occupy an area of approximately 5,000 m². The construction work for the shafts are estimated to take 5 months in total, however, the site has to remain in place for a significant period of time, as the Tunnel Boring Machine is being lifted out at Lockwood – one from the Beckton to Lockwood drive, and one from the King George V to Lockwood drive. As such, the habitat will be unavailable for approximately 33 months whilst the tunnels are bored.

Two c.150 m² areas of permanent infrastructure on neutral grassland with some scattered scrub will be required (see Figure 4-1 and Photo 4-1). These are estimates only at this conceptual design stage and will be refined during Gate 3 as part of the detailed design work.

A permanent cap will be required to access the shaft, in addition to a small kiosk to house telemetry and level sensors. An extension to the existing access road (proposed Type 1 material) at the base of the reservoir embankment will also be required to provide permanent access to the shafts. This is estimated to be approximately 40m in length, 5m wide. Interconnecting pipework between the shafts and the existing Lockwood pumping station would ideally be above ground (engineering preference), however, there is the option to bury this if required.

The shafts are sited specifically at the Lockwood Reservoir site in order to connect to the Thames Lee Tunnel (TLT) and utilise existing infrastructure (pumping station, spillway into Low Maynard Reservoir) as part of the engineering conceptual design. Suitable locations to connect to the TLT elsewhere along the route have been restricted by other engineering, social and environmental constraints. A particular engineering complexity is that the TLT cannot be easily drilled down onto, without risk of collapse. As such, the Lockwood Reservoir is at the end of the tunnel and therefore, minimises risk of infrastructure failure.

Natural England commissioned a report into small scale effects[60] and how authoritative decisions under the Habitats Regulations have been made with respect to both habitat loss and deterioration within the boundaries of Special Areas of Conservation (SACs) and SPAs. It concluded that scale was only one factor when considering the significance of habitat loss or deterioration. A wider range of factors were considered

[60] Chapman C and Tyldesley D (2016) *Small-scale effects: How the scale of effects has been considered in respect of plans and projects affecting European sites - a review of authoritative decisions.* Natural England Commissioned Reports, Number205.

"*..including the characteristics of the qualifying feature (for example, rarity, location, distribution, vulnerability to potential change), how the ecological structure and function of the site might be affected, what ecological function the affected area is performing, or could perform, in terms of the ecological requirements of the qualifying features, the location of the affected area both in terms of its geographic position in the designated site and in terms of its position relative to the project*".

Therefore, to help determine whether the permanent loss of habitat within the Lee Valley SPA and Ramsar would be considered an adverse effect, consideration needs to be given to the functional role it provides in supporting the qualifying features.

The Supplementary Advice on Conservation Objectives (SACO) for the site[61], produced by Natural England to identify attributes and targets to achieve Favourable Conservation Status, does not include mention of neutral grassland as a supporting habitat:

- Great bittern - Restore the extent and distribution of suitable supporting habitat which supports great bittern
    - Standing open water and canals (345 hectares)
    - Fen, reedbed, marsh and swamp (19.2 hectares)
- Gadwall – Maintain the extent and distribution of suitable habitat with supports gadwall
    - Standing open water (345 hectares)
- Northern shoveler – Restore the extent and distribution of suitable habitat which supports northern shoveler
    - Standing open water 345 hectares.

Great bittern mainly feed within or near to reedbeds of large waterbodies[61] and are not typically recorded in open habitats. The proposed location for the Lockwood primary and secondary shafts is not anticipated to provide moulting, roosting, loafing or feeding habitat for great bittern.

Gadwall occupy gravel pits, lakes, reservoirs, coastal wetlands and estuaries during the winter to feed on seeds, leaves and stems of aquatic plants[62,61]. Northern shoveler occupy shallow water habitats during the winter including reservoirs, marshes and flooded pasture, where marginal reeds and emergent vegetation provide key feeding sites[61]. There is potential for gadwall and northern shoveler to use neutral grassland for resting and loafing during daylight hours, although the area being considered also comprises scattered scrub so of lower habitat preference.

The Lee Valley was designated an SPA in September 2000. Using historic imagery in Google Earth, the area to be lost has always been very short grassland. Between 2003 and 2005 and access track extended around the toe of the reservoir embankment. The reservoir embankments and access track continue to be managed, with regular cutting of the grass. It is therefore considered unlikely that this area has ever provided a significant function in supporting the qualifying features.

4.2.2.1 Mitigation measures

To reduce the permanent land-take, the majority of the shaft will be covered with a shallow topsoil layer to allow grass regrowth. The access cover, kiosk and access track extension would be the permanent, above-ground loss (total m^2 to be confirmed at detailed design stage).

Additional measures to reduce the level of deterioration of the habitat within the construction compound should be considered e.g. minimise amount of topsoil stripping, use of matting to distribute weight and management programme during re-establishment to avoid weed growth.

Therefore, based on the small area proposed for construction (temporary loss and deterioration) and permanent habitat loss (access hatches, kiosks and access road), lack of species records on the neutral grassland and limited ecological functioning role of neutral grassland for gadwall and northern shoveler, no adverse effects are anticipated with some additional mitigation.

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[61] Natural England (2018). European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features. Lee Valley Special Protection Area. Natura 2000 database, 1 – 23.

[62] RSPB (2022). Gadwall. Accessed from: Gadwall Bird Facts | Anas Strepera - The RSPB

4.2.2.2 *Summary*

Table 4-8 summarises the *informal* Stage 2 Appropriate Assessment of the potential for terrestrial habitat loss caused by the Beckton water recycling scheme to lead to adverse effects on the Lee Valley SPA and Ramsar site and associated qualifying features.

Table 4-8 Summary of the potential for habitat loss caused by the Beckton water recycling scheme to lead to adverse effects on the Lee Valley SPA and Ramsar and associated qualifying features.

Parameter	Summary
Impact type	Impacts associated with habitat destruction and habitat loss within the boundaries of the Lee Valley SPA and Ramsar site could have a direct impact on some of the qualifying species of the Lee Valley SPA and Ramsar site.
Receptor	The Lee Valley SPA is designated for the following qualifying features: • Great bittern *Botaurus stellaris* (non-breeding) • Gadwall *Anas strepera* (non-breeding) • Northern shoveler *Anas clypeata* (non-breeding) The Lee Valley Ramsar protects the following qualifying features: • Whorled water-milfoil *Myriophyllum verticillatum* • Waterboatman *Micronecta minutissima* The two qualifying features of the Ramsar site are aquatic and are present within the waterbodies only. Therefore, permanent terrestrial land-take will not result in an adverse effect on these species. The Ramsar is also designated for over-wintering gadwall and northern shoveler, as identified for the SPA. The impact is therefore confined to the bird features which may be using the grassland habitat.
Probability	The impact will occur.
Magnitude	In relation to the area of Lee Valley SPA and Ramsar site, the areas proposed for construction are considered to be small. In addition, due to the low habitat suitability of habitats that will be directly lost during proposed construction works at Compound/ Shaft 6 and 10, the magnitude of the impact is deemed low.
Extent	Temporary deterioration of 5,000 m² due to construction area at Lockwood compound/shaft 6 (primary and secondary shafts) Permanent loss of 500m² of neutral grassland with some scattered scrub (access hatches, kiosk and access road). Interconnecting pipework between the shafts and the existing Lockwood pumping station would ideally be above ground from an engineering perspective, however, there is the option to bury this if required. An extension to the existing access track will be required to gain access to the shafts.
Duration	The above ground infrastructure will result in a permanent loss of habitat. There will be a medium term loss and/or deterioration in habitat over the area of the construction site (33 months) and the trenched section for the interconnecting pipework. Neutral grassland is estimated to be re-established within 5 years.
Timing	Timings are not known at this stage.
Frequency	Once during construction.
Reversibility	Not reversible for above-ground infrastructure until decommissioning. Temporary deterioration impacts are considered to be reversible given the habitat type.
Mitigation	• Minimise extent of construction compounds, and use of geotextile matting to distribute weight under stockpiles and access tracks. • Minimise area of permanent infrastructure and include for a shallow grass layer over as much of the shaft site as possible. • During re-establishment of vegetation, intrusive treatments may be required to avoid weed growth becoming dominant (e.g. ragwort pulling/spraying).
Summary	No adverse effects on site integrity anticipated.

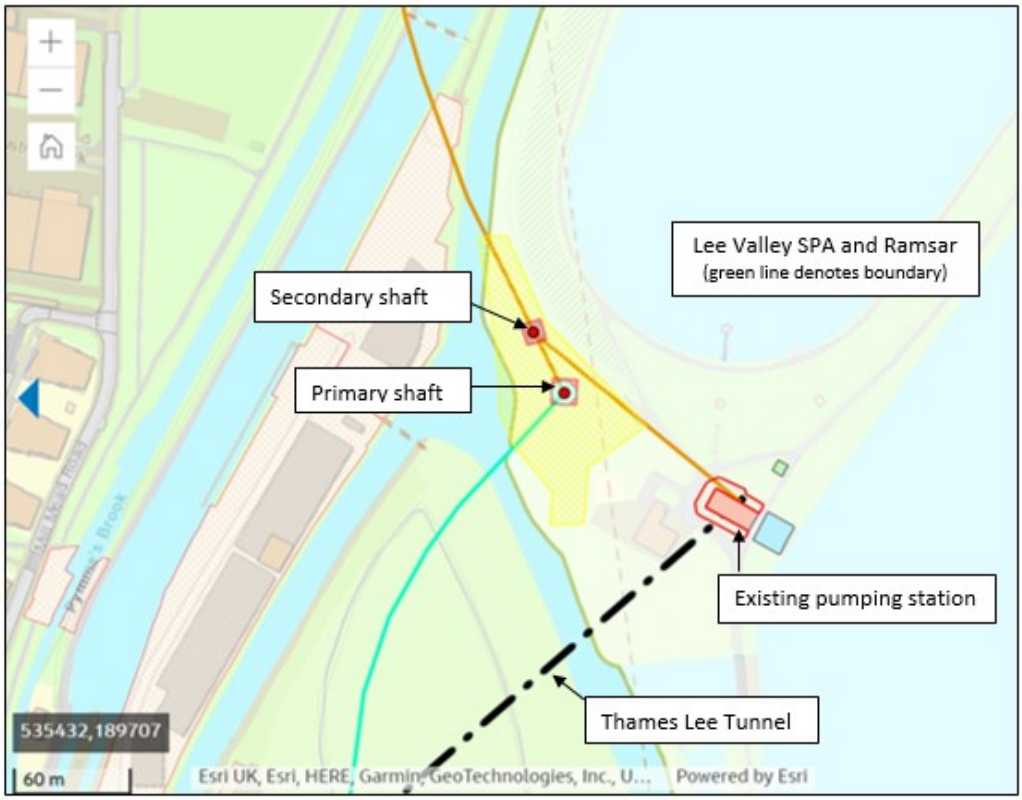


Figure 4-1 Proposed shaft locations to south west of Lockwood Reservoir

Photo 4-1 Photographs from site visit (Dec 2021) of area for proposed shaft location

4.2.3 Assessment of flight barriers

4.2.3.1 Construction of primary and secondary shafts at Lockwood Reservoir

It is proposed that the Tunnel Boring Machine drive the tunnel sections from Beckton STW to Lockwood Reservoir and from King George V to Lockwood Reservoir. To remove the Tunnel Boring Machine at Lockwood, a gantry crane (c.10m tall) will be required.

There are constraints at the shafts that will limit the height and width of the gantry crane, including overhead pylons and water mains. Use of the gantry crane will be required 24 hours, seven days a week once deployed and two Tunnel Boring Machines will be removed, one at Shaft 6 (one Beckton STW) and one at Shaft 5 (from King George V), which will take approximately 3 weeks to dismantle and lift out, each.

Due to the complexities of boring the tunnel sections and finishing at Lockwood Reservoir, it cannot be guaranteed when the gantry cranes will be actively in use. It is also uncertain how far in advance the crane will need to be positioned ahead of being required to lift out the Tunnel Boring Machine.

Therefore, there is a high likelihood that the installation of the gantry cranes will overlap with at least one overwintering period (October – March inclusive), but potentially up to three seasons if the crane is installed at the beginning of the conveyance construction programme. Therefore consideration needs to be given to whether the gantry crane has the potential to create a physical barrier to flight for qualifying species of the Lee Valley SPA and Ramsar site between feeding and roosting grounds.

This is relevant to the following attribute within the SACO for the Lee Valley SPA[63]:

- Great bittern and northern shoveler - Connectivity with supporting habitats.

Gadwall does not have a similar attribute or target, suggesting the species may be less susceptible to collisions.

Great bittern have been recorded flying at heights of up to 60 m and for up to 10 minutes[64], and the Lee Valley SPA SACO states that bittern are known to collide with overhead power cables. Great bittern commute between multiple sites to feed and roost with in the Lee Valley. Wetland Bird counts have previously indicated that individual birds generally visit Walthamstow Reservoirs once in every five years and this southernmost site probably serves as a harsh winter refuge[65]. Note that no great bittern has been recorded at Walthamstow Reservoirs, Banbury Reservoir or King George V Reservoir from 2015 – 2020. The three SSSIs (Turnford and Cheshunt Pits, Amwell Quarry and Rye Meads) north of the Beckton water recycling scheme provide adequately connected suitable habitat capable of supporting a favourable SPA population. Therefore, presence of great bittern during construction works is deemed unlikely.

No specific information was found on gadwall and shoveler flight heights; however, during migration ducks are known to fly from 60 – 12,000 m high and both species are more likely to be present at Walthamstow Reservoirs if construction works overlap with the overwintering season.

As the three underpinning SSSIs that provide supporting habitat to qualifying species of the Lee Valley SPA and Ramsar site are located north of Shaft 6 at Lockwood, it is anticipated that limited commuting activity occurs from east to west. The closest SSSI that has been identified that could support qualifying species of the Lee Valley SPA is Brent Reservoir SSSI, which is approximately 12 km west. However, it is deemed unlikely to provide a key feeding or roosting site due to the distance and associated energy expenditure to commute between Walthamstow Reservoirs and Brent Reservoir SSSI.

The positioning of the gantry crane at Lockwood Reservoir is also at the toe of the existing reservoir embankment, and in proximity to a pylon and overhead power lines which have been in-situ since the SPA was designated. As such, the bird populations are considered to be habituated to obstacles in this area of the wider reservoir network.

[63] Natural England (2018). European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features. Lee Valley Special Protection Area. Natura 2000 database, 1 – 23.

[64] Heron Conservation (2022). Eurasian bittern. Accessed from: HeronConservation » Eurasian Bittern

[65] Natural England (2018). European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features. Lee Valley Special Protection Area. Natura 2000 database, 1 – 23.

Therefore given the positioning of the gantry crane at the toe of the existing reservoir embankment and low likelihood of commuting routes from east to west across the site (based on the location of underpinning SSSIs and supporting habitat), no adverse effects on qualifying bird species are anticipated.

4.2.3.2 Summary

Table 4-9 summarises the *informal* Stage 2 Appropriate Assessment of the potential for the use of the gantry crane in the construction of the conveyance tunnel for the Beckton water recycling scheme to create physical barriers to flight between roosting and feeding sites for bird qualifying species of the Lee Valley SPA and Ramsar site.

Table 4-9 Summary of the potential for flight barrier creation caused by the Beckton water recycling scheme to lead to adverse effects on Lee Valley SPA and Ramsar site and associated qualifying features.

Parameter	Summary
Impact type	Indirect impacts associated with the requirement to use a gantry crane to remove the Tunnel Boring Machine and the creation of physical barriers to flight between feeding and roosting sites for qualifying species of the Lee Valley SPA and Ramsar site. Impact pathway identified at Compound/ Shaft 5 and 6.
Receptor	Great bittern and northern shoveler.
Probability	The probability of the impact is dependent on the location of key feeding and roosting sites for great bittern, northern shoveler and gadwall and the timing of construction works during the overwintering season (October – March inclusive). Underpinning SSSIs associated with the Lee Valley SPA and Ramsar site are largely located to the north and south of the SPA with limited sites to the west. In addition, use of the gantry crane will be limited to 6 months to remove the tunnel boring machine from the shaft.
Magnitude	Low level of impact anticipated based on existing physical barriers to flight (pylon and overhead cables) and topography of area (embanked reservoir).
Extent	Area of impact is small in relation to the size of the Lee Valley SPA/ Ramsar site. Due to the low probability of commuting routes from the reservoirs west, the magnitude of impact is deemed low.
Duration	Uncertain – gantry crane could be in place for 33 months if installed at beginning of entire construction programme (worst case).
Timing	Timing of construction is unknown at this stage, but could coincide with up to 3 overwintering periods.
Frequency	Once.
Reversibility	The potential impacts are considered reversible.
Mitigation	Not required.
Summary	No adverse effects on site integrity anticipated.

4.2.4 Assessment of noise disturbance

4.2.4.1 Lee Valley SPA and Ramsar

4.2.4.1.1 Construction of conveyance route shafts and construction compounds

The proposed construction works at Compound/ Shaft 5 Coppermills are adjacent to the Lee Valley SPA and Ramsar site; Compound/ Shaft 6 Lockwood is within the boundary; Compound/ Shaft 10 and outfall is approximately 7.4 km north; Compound/ Shaft 3 is 4.8 km south-east and Compound/ Shaft 2 is 5.9 km south-east. Construction works at the outfall will take ~7 months, with no set timescale provided for each Compound/ Shaft location. On that basis, if construction works are undertaken during the overwintering season (October – March inclusive), potential adverse effects have been identified due to noise, vibration and visual disturbance on great bittern, gadwall and northern shoveler. For Compound/ Shaft 10, that is on the basis that King George V Reservoir is used as functionally linked habitat by qualifying features of the Lee Valley SPA and Ramsar site. In addition, for Compound/ Shaft 2 and 3, that is on the basis that Wanstead Flats and associated ponds are used as functionally linked habitat.

This is relevant to the following attribute within the SACO for the Thames Estuary and Marshes SPA.

- Great bittern, gadwall and northern shoveler - Non-breeding population abundance.

- Great bittern, gadwall and northern shoveler - Minimising disturbance caused by human activity.

The WeBS survey site most relevant to Compound/ Shaft 5 and 6 is Walthamstow Reservoirs excluding Banbury (24107). For gadwall, the peak autumn[66] survey count in 2019/20 was 8 in September and peak wintering survey count was 45 individuals in December. During the five-year period of monitoring, from 2015 – 2020 the mean peak autumn count for gadwall was 13 and the mean peak winter count was 33. For northern shoveler, the peak autumn survey count in 2019/20 was 21 in October and peak wintering survey count was 4 in December. During the five-year period of monitoring, from 2015 – 2020 the mean peak count for northern shoveler in autumn was 48 and in winter was 30. No records of great bittern at Walthamstow Reservoirs excluding Banbury were received.

WeBS survey site Banbury Reservoir (24108) is approximately 420 m from the Lee Valley SPA and Ramsar site. Gadwall was the only qualifying feature that had been recorded there. Data provided were from 2009 – 2014, with no gadwall recorded at Banbury Reservoir in 2013/14 and a peak wintering survey count of 3 individuals in 2012/13 in February. No gadwall was recorded at the reservoir in the autumn.

WeBS survey site King George V Reservoir (24152) is approximately 4.6 km north of the Lee Valley SPA and Ramsar site. For gadwall, the peak autumn survey count in 2019/20 was 17 individuals in October and peak winter survey count was 31 in March. During the five-year period of monitoring from 2015 – 2020, the mean peak count for gadwall was 19 during autumn and 34 during the winter. For northern shoveler, the peak autumn survey count in 2019/20 was 120 individuals in September, and the peak winter survey count was 11 in November. During the five-year period of monitoring from 2015 – 2020, the mean peak count for northern shoveler was 104 in autumn and 12 in winter. No records of great bittern at King George V Reservoirs were received.

Based on WeBS survey outputs from 2019/20, the number of gadwall at both Walthamstow Reservoirs and King V George Reservoir was similar with peak mean counts during the winter ~30. Northern shoveler numbers are higher in the autumn, and they show a preference for King George V Reservoirs with peak mean counts of 104.

No counts were completed at Wanstead Flats during autumn. However, peak wintering survey counts for gadwall were 10 in 2020/21 in November, with a mean peak count of 7 from 2016 – 2021. Peak wintering survey counts for Northern shoveler were 17 in 2020/21 in November, with a mean peak count of 16 from 2016 – 2021. No records of great bittern at Wanstead Flats were received.

Desk based noise impact assessment outputs (see Table 4-10) found that noise levels will increase above ambient conditions over approximately 1.2 km² of Walthamstow Reservoirs as a result of construction work at Compound/ Shaft 5 and 6. The compounds and shafts will be constructed separately, therefore a combined noise impact is not anticipated. Rather different areas of the waterbody habitat, both within the boundary of the Lee Valley SPA and Ramsar and that considered to be functionally linked, will be disturbed consecutively.

Whilst construction is underway at Compound/shaft 5 at Coppermills (estimated to take 3 months), the LAmax of 87 dB (a 39 dB increase over the predicted baseline) will be experienced at the very edges of Reservoir Number 5 and Warwick Reservoir East, being the closest waterbodies to the shaft site. This increase exceeds the Natural England screening threshold of a 3 dB increase over baseline[67]. Based on the LAmax contours, the majority of Warwick Reservoir West and East and Reservoir Numbers 1-4, would experience an increase over the estimated baseline. The northern area of Leyton Marshes would also experience an increase over baseline. This increase will vary from a 3dB increase at the furthest point from the construction site to a 39dB increase in the immediate vicinity.

Whilst construction is underway at Compound/shaft 6 at Lockwood (estimated to take 5 months for both shaft sites), the LAmax is similarly predicted to be 87 dB (a 39 dB increase over the predicted baseline). This increase exceeds the Natural England screening threshold of a 3 dB increase over baseline. Again, based on the LAmax contours, the majority of the Lockwood Reservoir, all the High and Low Maynard Reservoirs, and the northern area of Reservoir Number 2 and 4, will experience an increase over the predicted baseline, varying from 3 dB at the furthest point from the construction site to 39 dB in the immediate vicinity.

[66] For the purposes of describing WeBS survey outputs, autumn is September – October and winter is November – March.

[67] 3 dB increase has been cited by Natural England in meetings (both LRU and other projects), however they are unable to issue the guidance as it is an internal document.

It is therefore highly likely that any species present within the affected area of Lee Valley SPA and Ramsar site will, as a result, move outside of the ZoI to northern sections of the Walthamstow Reservoirs and Banbury Reservoir. Based on this, disturbance-specific mitigation measures are required in order to prevent adverse effects on site integrity in relation to construction works at Compound/ Shaft 5 and 6.

The highest predicted construction noise at Chingford Reservoirs SSSI, the location of shaft 10 and the outfall onto the Lee Diversion Channel, was 57 dB LAmax with an increase above ambient of 9 dB predicted for 0.1 km² of the reservoir. This increase exceeds the Natural England screening threshold of a 3 dB increase over baseline[68]. The King George V reservoir is considered to be functionally linked habitat as part of the series of reservoirs that form the Lee Valley SPA and Ramsar. Construction of the shaft will take approximately 3.5 months, however, the outfall infrastructure will take longer and is estimated to take 7 months. An increase in noise level to 57 dB is deemed a moderate level of disturbance (see Appendix 1). Based on the small area of reservoir to be impacted, implementation of mitigation measures to reduce noise disturbance levels to minor and availability of neighbouring areas of suitable habitat (e.g. south of reservoir) no adverse effects are anticipated.

At Jubilee Pond in Wanstead Flats, the highest predicted noise level is 77 dB LAmax, a 29 dB increase over the predicted baseline. This increase exceeds the Natural England screening threshold of a 3 dB increase over baseline. Therefore, if qualifying species are present, it is likely they will be disturbed and commute away from the site. Based on this, disturbance-specific mitigation measures are required in order to prevent adverse effects on site integrity in relation to construction works at Compound/ Shaft 3.

Table 4-10 Beckton water recycling scheme: Predicted construction noise levels at Lee Valley SPA and Ramsar ornithological receptors[69]

Noise source	Receptor	Closest Distance (m)	Estimated Baseline	Highest Predicted Construction Noise	
			LAeq,day	LAeq,1hr [dB]	LAmax [dB]
Shaft 3 Wanstead Flats	Epping Forest SSSI	31	48	67	74
	WeBS Wanstead Flats	23	48	70	77
Shaft 5 Coppermills	Lee Valley SPA and Ramsar	4	48	79	87
	Walthamstow Reservoirs SSSI	4			
	WeBS Walthamstow Reservoirs excluding Banbury	0			
Shaft 6 Primary and Secondary shaft Lockwood	Lee Valley SPA and Ramsar	0	48	79	87
	Walthamstow Reservoirs SSSI	0			
	WeBS Walthamstow Reservoirs excluding Banbury	0			
King George V Reservoir – Shaft 10/outfall King George V Reservoir	Chingford Reservoirs SSSI	154	48	49	57
	WeBS Knights Pits, Lee Valley	374	48	40	47
	WeBS Gunpowder Park, Lee Valley	567	48	35	43
	WeBS King George V Reservoir	154	48	49	57

*Red boxes in the table represent where predicted noise levels during construction are ≥ 50 dB.

[68] 3 dB increase quoted in Natural England meetings, however, no publicly available guidance document.

[69] Red shaded cells indicate an exceedance of 3dB threshold above baseline.

4.2.4.1.2 Mitigation measures

The following mitigation measures should be considered to prevent adverse effects as a result of noise disturbance at Compound/ Shaft 3, 5 and 6:

- Suitable ornithologist to be present during site works to complete a toolbox talk prior to works and ensure a 200 m buffer is maintained between any qualifying species and the construction works. When qualifying species come within 200 m of construction, works must stop.
- Acoustic hoarding and housing of generators in acoustic kiosks will be required to reduce noise levels where elements of the construction phase are deemed to exceed noise thresholds.
- A temporary building with acoustic cladding could be erected over the shaft sites to provide further attenuation.
- All plant items must be properly maintained and operated according to manufacturers' recommendations and in such a manner as to avoid causing excessive noise.
- All plant items should be sited so that noise at nearby sensitive properties is minimised as far as possible.
- All plant items operating intermittently on the site should be shut down in the intervening periods.
- All pneumatic tools must be fitted with silencers or mufflers where practicable.
- No radios or music should be played on site.
- Wherever possible, dead-weight rollers must be used rather than vibratory rollers/compactors.

At Gate 2 only high level noise assessments have been undertaken, with estimated baseline and predicted construction levels. This will be refined for Gate 3 with noise monitoring to be completed at the relevant receptor sites. Survey work is also proposed to understand the use of the reservoir waterbodies by the wintering bird species. Any monitoring from other Thames Water projects will also be reviewed to understand potential habituation of birds, as both Lockwood and Coppermills are operational sites with frequent construction works. However, further noise modelling will be required to evidence that noise levels can be reduced to a level considered insignificant for the overwintering bird populations.

If it is found that the above mitigation cannot achieve the desired noise reduction, the construction of the shafts will need to be undertaken outside the overwintering period to ensure no adverse effects on integrity.

4.2.4.1.3 Summary

Table 4-11 summarises the *informal* Stage 2 Appropriate Assessment of the potential for noise disturbance caused by the Beckton water recycling scheme to lead to adverse effects on the Lee Valley SPA and Ramsar site and associated qualifying features**.**

Table 4-11 Summary of the potential for noise disturbance caused by the Beckton water recycling scheme to lead to adverse effects on overwintering bird populations of the Lee Valley SPA and Ramsar

Parameter	Summary
Impact type	Impacts associated with noise, vibration and visual disturbance could have a direct impact on qualifying species of the Lee Valley SPA and Ramsar site if present within the ZoI.
Receptor	Overwintering populations of great bittern, northern shoveler and gadwall.
Probability	The impact is likely to occur in the absence of mitigation measures due to the extent of the construction activities and the presence of qualifying features within the impacted area.
Magnitude	An exceedance of Natural England's 3dB screening threshold has been identified at the majority of sites. The maximum change over estimated baseline noise levels is 39dB (LAmax) at both Coppermills and Lockwood.
Extent	Changes in levels over the estimated baseline were found within 1.25km radius from each of the proposed construction work sites.
Duration	Outfall construction at King George V Reservoir (Compound/ Shaft 10) is estimated to take 7 months. Construction of each of the shaft locations will take approximately 3 months, and will be undertaken consecutively rather than together.
Timing	Timing of construction is unknown at this stage.

Parameter	Summary
Frequency	Once at shaft sites 3, 5 and 6. Twice at King George V reservoir – once for shaft 10 and once for outfall construction. Disturbance could occur over a maximum of 3 overwintering periods, although will affect different areas of the Lee Valley SPA and Ramsar, and functionally linked habitat.
Reversibility	Reversible.
Mitigation	Mitigation measures should be considered at this stage to prevent adverse effects on site integrity. However, additional site-specific noise monitoring is required to improve the accuracy of desk based noise impact assessments completed plus wintering bird surveys to understand distribution of qualifying features within the zone of influence. Where mitigation measures identified in Section 4.2.4.1.2 are not sufficient to avoid an adverse effect, timing of works will need to be considered at Gate 3 to avoid overwintering period (not possible for the AWRP), or a set of noise thresholds (including consideration of weather conditions) agreed with Natural England for the noisiest works.
Summary	No adverse effects on site integrity anticipated with the implementation of mitigation measures.

4.2.4.2 Thames Estuary and Marshes SPA and Ramsar: functionally linked habitat

4.2.4.2.1 Construction of Beckton AWRP

The proposed construction of Beckton AWRP is approximately 24.3 km north-west of the Thames Estuary and Marshes SPA and Ramsar site and will take ~ 11 months to construct. Due to the estimated timeframe, construction works will overlap with the overwintering season. There is potential that qualifying waterbirds of the Thames Estuary and Marshes SPA and Ramsar site use saltmarsh and mudflat priority habitat present in Barking Creek as roosting and feeding grounds over winter (functionally linked habitat). Therefore, there is the potential for adverse effects on qualifying populations due to noise, vibration and visual disturbance at Barking Creek.

Based on protected species records from Essex Field Club, the following qualifying features have been recorded within 1 km of the proposed Beckton AWRP: black-tailed godwit, hen harrier, ringed plover and pochard. Black-tailed godwit and pochard were recorded in 2019 in Beckton STW lagoons, ringed plover in 2017 in Barking Creek and hen harrier in 2016 to the west of Beckton STW. No WeBS core count data is available for Barking Creek.

This is relevant to the following attribute within the SACO for the Thames Estuary and Marshes SPA:

- Waterbird assemblage and qualifying species - Non-breeding population abundance and diversity.
- Waterbird assemblage and qualifying species - Disturbance caused by human activity.

Desk based noise impact assessment outputs (see Table 4-12) found that noise levels will increase above ambient conditions over approximately 0.07 km² of riverine, saltmarsh and mudflat habitat within Barking Creek. The highest predicted construction noise is 77 dB LAmax at the mudflat priority habitat, a 22 dB increase over the predicted baseline and 88 dB LAmax at saltmarsh priority habitat, a c38dB increase over the predicted baseline. These increases exceed the Natural England screening threshold of a 3 dB increase over baseline[70]. The construction duration of the AWRP will also span three overwintering periods (total construction period for AWRP is 33 months).

It is highly likely that any species present within the affected area will commute downstream towards the Thames Estuary. However, it is acknowledged that the protected species records do not reflect waterbird activity within the last two years, and so additional overwintering surveys are recommended to determine bird activity in the upper reach of Barking Creek in order to reduce any residual uncertainty around the above conclusion.

[70] 3 dB increase quoted in Natural England meetings, however, no publicly available guidance document.

Table 4-12 Beckton water recycling scheme: Predicted construction noise levels at functionally linked habitat of the Thames Estuary and Marshes SPA and Ramsar ornithological receptors

Noise source	Receptor	Closest Distance (m)	Estimated Baseline	Highest Predicted Construction Noise	
			LAeq,day	LAeq,1hr [dB]	LAmax [dB]
Beckton STW AWRP	Mudflat priority habitat	24	55	69	77
	Saltmarsh priority habitat	9	50	80	88
	WeBS River Roding – Ilford – A13	177	55	48	55

*Red boxes in the table represent where predicted noise levels during construction are ≥ 50 dB.

4.2.4.2.2 Mitigation measures

The same mitigation measures as those specified for Lee Valley SPA and Ramsar (Section 4.2.2.1.2) should be considered to prevent adverse effects from noise disturbance to bird species using habitats on Barking Creek, which based on available evidence, are considered to be functionally linked to the Thames Estuary and Marshes SPA and Ramsar.

At Gate 2 only high level noise assessments have been undertaken, with estimated baseline and predicted construction noise levels. This will be refined for Gate 3 with noise monitoring to be completed at the relevant receptor sites. Survey work is also proposed along the River Roding to understand the use of the habitats by the overwintering bird species. Any monitoring undertaken as part of the Beckton STW upgrade will also be reviewed to understand potential habituation of birds in the area. However, further noise modelling will be required to evidence that noise levels can be reduced to a level considered insignificant for the overwintering bird populations.

If it is found that the above mitigation cannot achieve the desired noise reduction, the construction programme and techniques will need to be reviewed to ensure timing of works outside the overwintering period to ensure no adverse effects on integrity. Construction works at the AWRP site cannot be achieved outside the wintering bird period, therefore the construction programme and techniques will need to be reviewed to try and enable the noisiest works to be completed outside the wintering period, or a set of noise thresholds (taking account of weather conditions) under which works can be carried out. The British Association of Shooting and Conservation (BASC) severe weather warning provides for the suspension of shooting in prolonged cold weather (between November and February) to reduce disturbance to waterfowl. Adherence to these warnings, and a cessation of works on site, may be required if the more standard mitigation measures are insufficient to conclude no adverse effect.

4.2.4.2.3 Summary

Table 4-13 summarises the *informal* Stage 2 Appropriate Assessment of the potential for noise disturbance caused by the Beckton water recycling scheme to lead to adverse effects on functionally linked habitat to the Thames Estuary and Marshes SPA and Ramsar site and associated overwintering bird populations.

Table 4-13 Summary of the potential for noise disturbance caused by the Beckton water recycling scheme to lead to adverse effects on functionally linked habitat to the Thames Estuary and Marshes SPA and Ramsar overwintering bird populations

Parameter	Summary
Impact type	Impacts associated with noise, vibration and visual disturbance could have a direct impact on qualifying species of the Thames Estuary and Marshes SPA and Ramsar site if present within the ZoI.
Receptor	Overwintering populations of avocet, black-tailed godwit, dunlin, grey plover, hen harrier, knot, redshank, ringed plover and the waterbird assemblage.
Probability	The impact is likely to occur in the absence of mitigation measures due to the extent of the construction activities and the presence of qualifying features within the impacted area.

Parameter	Summary
Magnitude	An exceedance of Natural England's 3dB screening threshold has been identified at the functionally linked habitats within Barking Creek, directly east of the Beckton STW site. The maximum change over estimated baseline noise levels is 38dB (LAmax).
Extent	Changes in levels over the estimated baseline were found within 1.25km radius from each of the proposed construction work sites.
Duration	Construction of the AWRP is estimated to take 33 months and encompass 3 overwintering periods.
Timing	Timing of construction is unknown at this stage.
Frequency	Disturbance could frequently occur over a maximum of 3 overwintering periods, affecting the same area of functionally linked habitat.
Reversibility	Reversible
Mitigation	Mitigation measures should be considered at this stage to prevent adverse effects on site integrity. However, additional site specific noise monitoring is required to improve the accuracy of desk based noise impact assessments completed plus wintering bird surveys to understand distribution of qualifying features within the zone of influence. Where mitigation measures identified in Section 4.2.4.2.2 are not sufficient to avoid an adverse effect, timing of works will need to be considered at Gate 3 to avoid overwintering period (not possible for the AWRP), or a set of noise thresholds (including consideration of weather conditions) agreed with Natural England for the noisiest works.
Summary	No adverse effects on site integrity anticipated with the implementation of mitigation measures.

4.2.5 Assessment of dust and air quality emissions

4.2.5.1 Lee Valley SPA and Ramsar

4.2.5.1.1 Construction of Conveyance Route Compounds and Shafts

The following Compounds/ Shafts have been identified that are within 50 m of ecological receptors: Compound/ Shaft 5, 6 and 10. See Section 4.2.1 for autumn and wintering peak counts of gadwall and northern shoveler in Walthamstow Reservoirs, Banbury Reservoir and King George V Reservoir. Potential adverse effects from traffic emissions (NOx and particles (PM_{10}) emissions) and dust from earthworks have been identified where Shafts/ Compounds are within close proximity of open water supporting habitat. In general, the haul routes that could be used by construction vehicles are >200 m from the SPA and Ramsar site, with the exception of the A503 which is likely to be used when constructing the primary and secondary shafts at Lockwood Reservoir, and Coppermill Lane to access Compound/Shaft 5.

Traffic emissions and dust could impact on water quality, and therefore prey items for bittern, and health/ extent of macrophytes (*Phragmites*) which provide shelter for great bittern and are a key food source for gadwall and northern shoveler. This could also impact on the health and extent of whorled water-milfoil and cause direct mortality and deterioration of supporting habitat for waterboatman (qualifying species of the Lee Valley Ramsar site).

This is relevant to the following attributes within the SACO for the Lee Valley SPA bird features:

- Great bittern, gadwall and northern shoveler - Supporting habitat (both within and outside the SPA): Air quality.
- Great bittern, gadwall and northern shoveler - Supporting habitat (both within and outside the SPA): Water quality/ quantity.
- Great bittern, gadwall and northern shoveler - Supporting habitat (both within and outside the SPA): Vegetation characteristics.

For standing open water habitat and canals that support northern shoveler, there is no comparable habitat with established critical load estimates available for atmospheric nitrogen deposition[71]. The critical level of oxides

[71] Critical loads are defined as the deposition flux of an air pollutant below which significant harmful effects on sensitive ecosystems do not occur, according to present knowledge. Usually measured in units of kilograms per hectare per year (kg/ha/yr).

of nitrogen is 30 µg NOx m³ annual mean[72,73]. As habitat sensitivity depends on nitrogen and phosphate limitation, site specific conditions need to be taken into consideration when addressing the potential impacts of air pollution. Waterbodies in the Lee Valley SPA are phosphate limited rather than nitrogen limited. Therefore, it is phosphate availability that controls the growth of macrophytes and algae.

Construction works associated with Compound/ Shafts 5, 6 and 10 are not anticipated to affect phosphate availability within any component of the SPA/ Ramsar site or its supporting waterbodies. In addition, the impact of construction works on pollutant deposition rate and gaseous concentrations within the European site are anticipated to be short term, temporary and reversible in nature. However, air quality modelling of emissions has not been completed for Gate 2, and therefore there is uncertainty as to whether the 24 hour critical loads will be exceeded. As such, further assessment will be carried out for Gate 3 to address this uncertainty.

Therefore, assuming the precautionary principle, additional mitigation measures are required to prevent adverse effects as a result of dust and air quality emissions.

4.2.5.1.2 Mitigation measures

Best practice dust mitigation measures to ensure minimal dust emissions such as proper site management, maintenance of the site and machinery used onsite, waste management and measures to reduce dust emissions from demolition, earthworks, construction and track-out as described in the IAQM guidance[74] would be applicable to medium to high-risk sites during the construction phase.

The following mitigation measures should be considered to reduce the potential adverse effects of dust emissions on the reservoirs (freshwater habitat) and neutral grassland habitats:

- Planning site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Ensuring an adequate water supply for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- Reuse and recycle waste to reduce dust from waste materials;
- Ensure water suppression is used during demolition, excavation and other earth-moving operations;
- Any demolition or concrete breakout to be undertaken in suitable weather conditions i.e. avoiding windy conditions; and
- Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport.

After implementation of these mitigation measures, dust impacts are not anticipated to be significant.

Emissions from traffic (HGVs), plant and NRMM will require further evaluation and modelling before mitigation can be fully defined.

4.2.5.1.3 Summary

Table 4-14 summarises the *informal* Stage 2 Appropriate Assessment of the potential for and dust and traffic emissions caused by the Beckton water recycling scheme to lead to adverse effects on the Lee Valley SPA and Ramsar site and associated qualifying features.

Table 4-14 Summary of the potential for dust emissions and traffic and plant emissions caused by the Beckton water recycling scheme to lead to adverse effects on Lee Valley SPA and Ramsar site and associated qualifying features.

Parameter	Summary
Impact type	Impacts associated with dust and traffic/NRMM emissions from construction activities could have an indirect impact on supporting habitat of qualifying species of the Lee Valley SPA and Ramsar site.
Receptor	Overwintering bird populations; great bittern, gadwall and northern shoveler

[72] APIS (2021). South West London Waterbodies SPA. Air Pollution Information System. Accessed from: http://www.apis.ac.uk/srcl/select-a-feature?site=UK9012171&SiteType=SPA&submit=Next

[73] APIS (Air Pollution Information System) provides a comprehensive source of information on air pollution and the effects on habitats and species.

[74] Institute of Air Quality Management IAQM (2017) Guidance on the Assessment of Dust from Demolition and Construction v1.1

Parameter	Summary
	Whorled water-milfoil and waterboatman.
Probability	The impact is likely to occur in the absence of mitigation measures due to the extent of the construction activities and proximity of some haul routes to the supporting habitat within the impacted area.
Magnitude	The potential air quality impacts on ecological receptors were considered within a 200 m radius from the construction footprint. The risk of air quality impacts on ecological receptors present within 20 m was classified as major for earthworks and construction of shafts.
Extent	Up to 200m radius around construction sites and haul roads.
Duration	It is anticipated that construction works at Beckton STW will take approximately 11 months to complete.
Timing	Timing of construction is unknown at this stage.
Frequency	Frequent within construction of shaft site (c.3 months).
Reversibility	Uncertain – further air quality modelling is required to understand exceedance of critical loads on the supporting habitats. .
Mitigation	Best practice dust mitigation measures to ensure minimal dust emissions. Emissions from traffic (HGVs, plant) and NRMM will require further evaluation and modelling before mitigation can be fully defined.
Summary	No adverse effects on site integrity anticipated with the implementation of mitigation measures. Further assessment required to confirm suite of mitigation measures required to ensure no adverse effect on site integrity from traffic/plant/NRMM emissions.

4.2.5.2 Thames Estuary and Marshes SPA and Ramsar: functionally linked habitat

4.2.5.2.1 Construction of Beckton AWRP

Construction works associated with Beckton AWRP are approximately 20 m from the upper saltmarsh priority habitat and 30 m from mudflat priority habitat in the River Roding/Barking Creek at the closest point. The total length of the proposed facility adjacent to Barking Creek is 240 m. As the boundary of Barking Creek remains within 50 m for the 240 m length of the proposed Beckton AWRP, saltmarsh and mudflat priority habitat will be exposed to major impacts from dust emissions and increased air pollution during 33 months of construction work. In general, the haul routes that could be used by construction vehicles are >200m from the Barking Creek supporting habitat, with access to the Beckton STW taken via Jenkins Lane off the A13.

Based on protected species records from Essex Field Club, the following qualifying features have been recorded within 1 km of the proposed Beckton AWRP: black-tailed godwit, hen harrier, ringed plover and pochard. Black-tailed godwit and pochard were recorded in 2019 in Beckton STW lagoons, ringed plover in 2017 in Barking Creek and hen harrier in 2016 to the west of Beckton STW. No WeBS core count data is available for Barking Creek. Therefore, potentially functionally linked habitat for the bird qualifying features of the Thames Estuary and Marshes SPA and Ramsar site (which is 24.3 km downstream) could be exposed to smothering by dust and habitat deterioration through traffic and NRMM emissions. The initial air quality appraisal has suggested that approximately 0.29 g/s and 4.74 g/s of PM_{10} and NO_x, respectively could be emitted from the Beckton AWRP site. Exceeding critical values[75] for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats.

This is relevant to the following attributes within the SACO for the Thames Estuary and Marshes SPA:

- Waterbird assemblage and qualifying species - Non-breeding population abundance and diversity.
- Waterbird assemblage and qualifying species - Supporting habitat: air quality.
- Waterbird assemblage and qualifying species - Supporting habitat: quality of supporting non-breeding habitat.

[75] Available from the Air Pollution Information System (APIS). Accessed at http://www.apis.ac.uk/.

No site-specific baseline air quality information is available for Barking Creek, however, critical levels for saltmarsh vegetation is typically 30 µg NOx/m^3 annual mean[76]. It is also acknowledged that protected species records do not reflect waterbird activity within the last 2 years, and so additional overwintering bird surveys are recommended to determine bird activity in the upper reach of Barking Creek in order to reduce uncertainty and confirm this conclusion.

The air quality assessment will need to be updated to reflect a more defined plant list for the Beckton AWRP site, but air quality modelling is likely to be required to further understand the potential impacts on the functionally linked habitats.

4.2.5.2.2 Mitigation measures

The same mitigation measures as those specified for Lee Valley SPA and Ramsar (Section 4.2.5.1.2) should be considered to prevent adverse effects from dust to bird species using habitats on Barking Creek, which based on available evidence, are considered to be functionally linked to the Thames Estuary and Marshes SPA and Ramsar.

Emissions from traffic (HGVs), plant and NRMM will require further evaluation and modelling before mitigation can be fully defined.

4.2.5.2.3 Summary

Table 4-15 summarises the *informal* Stage 2 Appropriate Assessment of the potential for and dust and traffic emissions caused by the Beckton water recycling scheme to lead to adverse effects on European sites and associated qualifying features**.**

Table 4-15 Summary of the potential for dust emissions and traffic and plant emissions caused by the Beckton water recycling scheme to lead to adverse effects on European sites and associated qualifying features

Parameter	Summary
Impact type	Impacts associated with dust and traffic/NRMM emissions from construction activities could have an indirect impact on supporting habitat of qualifying bird species of the Thames Estuary and Marshes SPA and Ramsar site.
Receptor	Overwintering populations of avocet, black-tailed godwit, dunlin, grey plover, hen harrier, knot, redshank, ringed plover and the waterbird assemblage. The Ramsar invertebrate and wetland plant assemblage are not considered to be present in Barking Creek.
Probability	The impact will occur in the absence of mitigation measures.
Magnitude	The risk of dust effects was determined by the scale and nature of the works. The impact of dust on ecological receptors within 20 m of earthworks and construction of shafts and tunnels was classified as major. The potential for traffic/NRMM emission impacts on ecological receptors were considered within a 200 m radius from the construction footprint. It has been estimated that the operation of all the plant and NRMM would result in approximately 0.29 g/s and 4.74 g/s of PM_{10} and NO_x, respectively. The risk of air quality impacts is considered to be major.
Extent	Up to 200m radius around construction sites and haul roads.
Duration	It is anticipated that construction works at Beckton STW will take approximately 33 months to complete.
Timing	Timing of construction is unknown at this stage.
Frequency	Frequent throughout construction period.
Reversibility	Uncertain – further air quality modelling is required to understand exceedance of critical loads on the supporting habitats. .
Mitigation	Best practice dust mitigation measures to ensure minimal dust emissions. Emissions from traffic (HGVs), plant and NRMM will require further evaluation and modelling before mitigation can be fully defined.

[76] Available from the Air Pollution Information System (APIS). Accessed at http://www.apis.ac.uk/.

Parameter	Summary
Summary	No adverse effects on site integrity anticipated with the implementation of mitigation measures. Further assessment required to confirm suite of mitigation measures required to ensure no adverse effect on site integrity from traffic/plant/NRMM emissions.

4.2.6 Assessment of operation impact pathways

4.2.6.1 Change in hydrological regime

The physical environment assessments of London Effluent Reuse SRO at Gate 2 have been undertaken to assess change from a range of different appropriate reference conditions at times when a London Effluent Reuse SRO could be utilised. These reference conditions are different patterns of river flow and STW final effluent flow: a 1:5 return frequency moderate-low flow year (referred to hereafter as A82); and a 1:20 return frequency very low flow year (referred to hereafter as M96). Full details are provided in the Physical Environment assessment report (see Annex B.2.1).

An estuarine hydrodynamics assessment has been undertaken for both the A82 and M96 representative model years with a 300 Ml/d Beckton water recycling scheme. This represents a maximum (reduction) case of effluent contribution from Beckton STW to the middle Thames Tideway. For example, in the A82 scenario during the scheme on period, modelled Beckton STW reference condition flows are 1,170 Ml/d (daily mean). A 300 Ml/d Beckton water recycling scheme would reduce these flows by 300 Ml/d, a 26% reduction. The hydrodynamic output assessed the resultant changes to water levels, considering as far downstream at the Queen Elizabeth II bridge (A282) at Dartford (the Thames Estuary and Marshes SPA and Ramsar is >10km downstream of the bridge).

Modelling shows no discernible change in low tide water level for a 300 Ml/d Beckton water recycling scheme compared with reference conditions for A82 or M96 scenarios. It is noted for context, that the volume of estuarine water identified from the 2D/3D Telemac modelling as passing the point on the Thames Tideway at Beckton STW is 80 Mm^3 on each flood tide and each ebb tide on a spring tide; and 50 Mm^3 on each flood tide and each ebb tide on a neap tide. Both a 1,200 Ml/d reference condition flow contribution from Beckton STW and a 300 Ml/d effluent flow reduction from a 300 Ml/d Beckton water recycling scheme are very small proportions of that tidal exchange.

As such, no adverse effects are considered likely to mudflat and saltmarsh habitats between Beckton STW outfall and the Thames Estuary and Marshes SPA and Ramsar, which could be considered functionally linked habitat supporting the qualifying birds. Similarly, no impacts are therefore expected further downstream at the boundary of the SPA and Ramsar.

4.2.6.2 Change in water quality

An assessment has been undertaken to understand the resulting changes in water quality during operation of the Beckton water recycling scheme. Those parameters relevant to considering the potential for adverse effects on the bird qualifying features of the Thames Estuary and Marshes SPA and Ramsar, particularly considering functionally linked habitat (mudflats and saltmarsh) between the outfall and European site boundary, are as follows:

- Water temperature changes across the estuarine Thames Tideway.
- WFD physico-chemical supporting elements to ecological status, including dissolved oxygen saturation, total ammonia, reactive phosphorus, water temperature, pH and BOD across the estuarine Thames Tideway.
- WFD chemical suite across the estuarine Thames Tideway.

As with the physical environment assessment, modelling, where required, was undertaken for the A82 (moderate-low flow year) and M96 (very low flow year) scenarios.

Water temperature in the middle Thames Tideway was subsequently found not to change as consequence of reduced discharge from Beckton STW. As such water temperature was not included in the modelling suite for the 2D/3D Telemac modelling for the Beckton water recycling scheme. In addition, the data was not available to complete the assessment for dissolved oxygen concentration in the estuarine Thames Tideway.

The modelled data indicated that there is a minor increase in salinity under the Beckton water recycling scheme (300 Ml/d) scenario compared with baseline from approximately 30 km downstream of Teddington Weir. Salinity is consistent between baseline and the operation of Beckton water recycling (300 Ml/d) scheme in the first 30 km downstream of Teddington Weir. The greatest increase in maximum, mean and minimum salinity from baseline is approx. 0.7 ppt.

Dissolved inorganic nitrogen reduces when Beckton water recycling is in operation from August – November from ~250 µMol/l when the scheme is not in operation to fluctuating between 130 µMol/l – 250 µMol/l. These dissolved inorganic nitrogen values are indicative of good Water Framework Directive status, however, the overall transitional water of the Thames estuary is in moderate status for dissolved inorganic nitrogen.

A total of 15 Water Framework Directive chemicals exceeded the standard in the current baseline scenario. During operation of Beckton water recycling scheme one further chemicals exceeded the standard.

Therefore, based on the minor changes in water quality anticipated in the estuarine Thames tideway, no adverse effects are considered likely to mudflat and saltmarsh habitats between Beckton STW outfall and the Thames Estuary and Marshes SPA and Ramsar, which could be considered functionally linked habitat supporting the qualifying birds. Similarly, no impacts are therefore expected further downstream at the boundary of the SPA and Ramsar.

4.2.6.2.1 Mitigation measures

No mitigation measures are required.

4.2.6.2.2 Summary

Table 4-17 summarises the *informal* Stage 2 Appropriate Assessment of the potential for changes in hydrology and water quality caused by the Beckton water recycling scheme to lead to adverse effects on the Thames Estuary and Marshes SPA and Ramsar site and associated qualifying features.

Table 4-16 Summary of the potential for changes in hydrology and water quality caused by the Beckton water recycling scheme to lead to adverse effects on Thames Estuary and Marshes SPA and Ramsar site and associated qualifying features.

Parameter	Summary
Impact type	Changes in hydrology and water quality.
Receptor	Qualifying birds of the Thames Estuary and Marshes SPA and Ramsar and potential impacts on the suitability of supporting habitat such as mudflats and saltmarsh.
Probability	The impact is likely to occur during operation.
Magnitude	Modelling shows no discernible change in low tide water level for a 300 Ml/d Beckton water recycling scheme compared with reference conditions for A82 or M96 scenarios. The greatest increase in maximum, mean and minimum salinity from baseline is approx. 0.7 ppt. Dissolved inorganic nitrogen reduces when Beckton water recycling is in operation from August – November from ~250 µMol/l when the scheme is not in operation to fluctuating between 130 µMol/l – 250 µMol/l. Water temperature in the middle Thames Tideway was subsequently found not to change as consequence of reduced discharge from Beckton STW. During operation of Beckton water recycling scheme one further chemical exceeded the standard.
Extent	Estuarine Thames Tideway.
Duration	4 months.
Timing	Operation from 1st August – 31st November
Frequency	Annual
Reversibility	Not reversible.
Mitigation	Non required.
Summary	No adverse effects on site integrity anticipated.

4.3 MOGDEN WATER RECYCLING SCHEME

4.3.1 Baseline

4.3.1.1 South West London Waterbodies SPA and Ramsar

The South West London Waterbodies SPA (central location: Latitude 51.4614, Longitude -0.5242) covers 8.25km² and coincides with multiple SSSIs situated across the floodplain of the River Thames[77][78]. Similarly, the South West London Waterbodies Ramsar site (central location: Latitude 51.399722, Longitude 0.390556) covers 8.28km² [79]. The SPA and Ramsar site consist of numerous embanked water supply reservoirs and former gravel pits, supporting both artificial and semi-natural open water habitats located in Berkshire, Surrey and Greater London. These waterbodies are hydrologically connected to the River Thames via groundwater flowing through alluvial sands and gravels or through pumped supply and are surrounded by supporting habitats including scrub, grassland and woodland[78]. The SPA and Ramsar site are part of a network of waterbodies in London that support a variety of breeding and wintering waterbird assemblages. The South West London Waterbodies SPA and Ramsar site both were designated as they support internationally important non-breeding and wintering populations of northern shoveler and gadwall.

Northern shoveler

See Section 4.2.1.1 for information on this species from a wider context. The shoveler that occupy South West London Waterbodies SPA and Ramsar site during the winter have either derived from UK breeding populations or have migrated from breeding grounds present in colder climates. They typically arrive in September and remain in the UK until March – early April and are often sighted in pairs or small groups. The designated sites support an estimated 2.1% of the north-west/ central European population of northern shoveler (based on 5-year peak mean 1993/94 – 1997/98)[80].

Gadwall

See Section 4.2.1.1 for information on this species from a wider context. The gadwall present at South West London Waterbodies SPA and Ramsar site during the winter have either derived from UK breeding populations or have migrated from breeding grounds present in colder climates; including Fennoscandia, central and eastern Europe and western Russia[78]. The designated sites support an estimated 2.4% of the north-west European population of gadwall (based on 5-year peak mean 1993/94 – 1997/98)[81], although distributional changes and use of other waterbodies in the wider Thames Valley area have been noted previously[82].

4.3.1.2 WeBS core count data

WeBS from BTO was requested where impact pathways have been identified at reservoirs associated with the South West London Waterbodies SPA and Ramsar site. The data received is displayed in Table 4-17 - Table 4-18. The sites include Kempton Local Nature Reserve (24103) and Red House Reservoir (24104). WeBS core count data includes peak monthly counts of wetland birds over a five year period and the International and National importance of the site for each species. Data was provided of the peak counts in autumn and winter during a five year monitoring period; autumn is September – October and winter is November – March. There are data gaps during years when surveys were not completed, which are recorded as no counts (N/C).

[77] JNCC (2015). Natura 2000 – Standard Data Form, South West London Waterbodies SPA. Natura 2000 database, 1 – 10.

[78] Natural England (2018). European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features. South West London Waterbodies Special Protection Area. Natura 2000 database, 1 – 20.

[79] JNCC (2008). Information Sheet on Ramsar Wetlands (RIS). JNCC. Version 3.0, 1 – 8.

[80] English Nature (2000). EC Directive 79/409 on the Conservation of Wild Birds: Special Protection Areas (SPA). South West London Waterbodies, Classification citation, pg 1.

[81] English Nature (2000). EC Directive 79/409 on the Conservation of Wild Birds: Special Protection Areas (SPA). South West London Waterbodies, Classification citation, pg 1.

[82] Banks, A. N., Austin. G. E. and Rehfisch, M. M (2004). South West London Waterbodies SPA – Wildfowl Population Analysis. BTO Research Report 361.

Table 4-17 Autumn peak counts of qualifying species of the South West London Waterbodies SPA and Ramsar site at Kempton Local Nature Reserve and Red House Reservoir from 2015 – 2020.

WeBS site	Species	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Mean of peaks
Kempton Local Nature Reserve	Gadwall *Anas strepera*	16 (SEP)	24 (AUG)	36 (OCT)	14 (AUG)	6 (OCT)	19
	Northern shoveler *Anas clypeata*	7 (OCT)	24 (SEP)	3 (AUG)	10 (AUG)	37 (OCT)	16
Red House Reservoir	Gadwall	23 (SEP)	14 (SEP)	8 (SEP)	14 (OCT)	20 (OCT)	16
	Northern shoveler	7 (SEP)	0	0	3 (SEP)	1 (SEP)	2

Table 4-18 Winter peak counts of qualifying species of the South West London Waterbodies SPA and Ramsar site at Kempton Local Nature Reserve and Red House Reservoir from 2015 – 2020.

WeBS site	Species	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	Mean of peaks
Kempton Local Nature Reserve	Gadwall *Anas strepera*	8 (DEC)	27 (DEC)	38 (NOV)	47 (JAN)	6 (NOV)	25
	Northern shoveler *Anas clypeata*	7 (FEB)	2 (MAR)	3 (FEB)	24 (MAR)	4 (JAN)	8
Red House Reservoir	Gadwall	9 (DEC)	15 (NOV)	18 (DEC)	92 (NOV)	38 (NOV)	34
	Northern shoveler	0	0	2 (DEC)	0	3 (NOV)	1

4.3.2 Assessment of noise disturbance

4.3.2.1 Construction of AWRP and Shaft 10 and 11

The proposed construction of the Mogden water recycling AWRP near Kempton WTW is directly adjacent to the series of reservoirs at Kempton Park and therefore, the South West London Waterbodies SPA and Ramsar. Construction of the AWRP is estimated to take 27 months and will therefore overlap with the overwintering bird season. There is potential that qualifying waterbirds of the South West London Waterbodies SPA and Ramsar use the open waterbodies and adjacent grassland habitats (low likelihood based on species preferences). Therefore, there is the potential for adverse effects due to noise, vibration and visual disturbance.

This is relevant to the following attributes in the SACO for South West London Waterbodies SPA and Ramsar site:

- Gadwall and northern shoveler - Non-breeding population, population abundance.
- Gadwall and northern shoveler - Disturbance caused by human activity.

The WeBS survey site most relevant to the AWRP site and Compound/ Shaft 11 is Red House Reservoir (24104). For gadwall, the peak autumn survey count in 2019/20 was 20 in October and peak wintering survey count was 38 in November. During the five-year period of monitoring, from 2015 – 2020, the mean peak autumn count for gadwall was 16 and the mean peak winter count was 34. For northern shoveler, the peak autumn survey count in 2019/20 was 1 in September and peak wintering survey count was 3 in November. During the five-year period of monitoring, from 2015 – 2020, the mean peak autumn count for northern shoveler was 2, and the mean peak winter count was 1.

The WeBS survey site most relevant to Compound/ Shaft 10 is Kempton Local Nature Reserve (24103). For gadwall, the peak autumn survey count in 2019/20 was 6 in October and peak wintering survey count was 6

in November. During the five-year period of monitoring, from 2015 – 2020, the mean peak autumn count for gadwall was 19 and the mean peak winter count was 25. For northern shoveler, the peak autumn survey count in 2019/20 was 37 in October and peak wintering survey count was 4 in January. During the five year period of monitoring, from 2015 – 2020, the mean peak autumn count for northern shoveler was 16, and the mean peak winter count was 8.

Based on the WeBS peak count data, gadwall show a slight preference for Red House Reservoir, particularly during the winter, with low numbers of northern shoveler overall at Red House Reservoir. In comparison, Northern shoveler show a preference for Kempton Local Nature Reserve, particularly during the autumn.

Noise assessment outputs (see Table 4-19) found that noise levels at Shaft/ Compound 10 are predicted to be elevated above ambient conditions, across both Red House Reservoir and Kempton Local Nature Reserve (two key waterbodies of the South West London Waterbodies SPA and Ramsar site, 0.25 km²) to a maximum of 81 dB LAmax, a 33 dB change over baseline. This increase exceeds the Natural England screening threshold of a 3 dB increase over baseline[83] and is considering the 'worst case' construction LAmax. This could cause moderate – high disturbance, causing movement outside of the ZoI. It is deemed likely that birds will commute to either Stainhill Reservoir and Hampton Water Works to the south or to Kempton Park Gravel Pits to the west. This could have adverse effects on the abundance of northern shoveler in particular that show a preference for Kempton Local Nature Reserve.

At Shaft/ Compound 11, noise levels are predicted to increase above ambient conditions across Red House Reservoir and the southern section of Kempton Local Nature Reserve (approximately 0.15 km²) to a maximum of 76 dB LAmax. This could cause moderate – high disturbance, causing movement outside of the ZoI.

Construction of the AWRP site will result in a maximum increase in noise levels of 54 dB LAmax within the boundaries of the South West London Waterbodies SPA. More specifically, noise levels will be elevated across the entirety of Red House Reservoir (approximately 0.05 km²). As this is below 55 dB[84] (also see Appendix 1 for context), the construction of the AWRP is unlikely to have an adverse effect on waterbirds present within the boundaries of South West London Waterbodies SPA and Ramsar site. However, in the northern sections of Stainhill Reservoir and Hampton Water Works, which may provide functionally linked habitat to the SPA/ Ramsar, predicted noise levels exceed 55 dB LAmax and there is potential for qualifying birds (if present) to exhibit behavioural changes.

Based on this, disturbance-specific mitigation measures are required in order to prevent adverse effects on site integrity in relation to construction works at Compound/ Shaft 10, 11 and AWRP.

Table 4-19 Mogden water recycling scheme: Predicted construction noise levels at ornithological receptors[85]

Noise source	Receptor	Closest Distance (m)	Estimated Baseline	Highest Predicted Construction Noise	
			LAeq,day	LAeq,1hr [dB]	LAmax [dB]
AWRP site near Kempton WTW	South West London Waterbodies SPA and Ramsar	203	48	46	54
	Kempton Park Reservoirs SSSI	203			
	WeBS Stainhill Reservoirs	104	50	54	61
	WeBS Hampton Waterworks	119	50	52	60
	WeBS Sunnyside Reservoir	522	48	36	44
	WeBS Kempton Park Gravel Pits	726	48	32	40
	South West London Waterbodies SPA and Ramsar	26	48	69	76

[83] 3 dB increase quoted in Natural England meetings, however, no publicly available guidance document.

[84] Cutts, N., Phelps, A. and Burdon, D. (2009) Construction and waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA, Institute of Estuarine and Coastal Studies, University of Hull.

[85] Red shaded cells indicate an exceedance of 3dB threshold above baseline.

Noise source	Receptor	Closest Distance (m)	Estimated Baseline	Highest Predicted Construction Noise	
			LAeq,day	LAeq,1hr [dB]	LAmax [dB]
Shaft/ Compound site 11	Kempton Park Reservoirs SSSI	26			
	WeBS Stainhill Reservoirs	608	50	34	42
	WeBS Hampton Waterworks	804	50	31	39
	WeBS Sunnyside Reservoir	1138	48	28	35
	WeBS Kempton Park Gravel Pits	632	48	34	41
Shaft/ Compound site 10	South West London Waterbodies SPA and Ramsar	17	48	73	81
	Kempton Park Reservoirs SSSI	17			
	WeBS Stainhill Reservoirs	1138	50	28	35
	WeBS Hampton Waterworks	1264	50	28	34
	WeBS Kempton Park Gravel Pits	764	48	32	39
Shaft/ Compound site 9	South West London Waterbodies SPA and Ramsar	316	48	42	49
	Kempton Park Reservoirs SSSI	316			
	WeBS Kempton Park Gravel Pits	1107	48	28	35
Shaft/ Compound site 13	South West London Waterbodies SPA and Ramsar	945	40	38	37
	Kempton Park Reservoirs SSSI	945			
	WeBS Stainhill Reservoirs	886	50	30	38
	WeBS Kempton Park Gravel Pits	603	48	34	42

*Red boxes in the table represent where predicted noise levels during construction are ≥ 50 dB.

4.3.2.2 Mitigation measures

The following mitigation measures should be considered to prevent adverse effects as a result of noise disturbance at Compound/ Shaft 10, 11 and the AWRP site:

- Suitable ornithologist to be present during site works to complete a toolbox talk prior to works and ensure a 200 m buffer is maintained between any qualifying species and the construction works. When qualifying species come within 200 m of construction, works must stop.
- Acoustic hoarding and housing of generators in acoustic kiosks will be required to reduce noise levels where elements of the construction phase are deemed to exceed noise thresholds.
- A temporary building with acoustic cladding could be erected over the shaft sites to provide further attenuation.
- All plant items must be properly maintained and operated according to manufacturers' recommendations and in such a manner as to avoid causing excessive noise.
- All plant items should be sited so that noise at nearby sensitive properties is minimised as far as possible.
- All plant items operating intermittently on the site should be shut down in the intervening periods.
- All pneumatic tools must be fitted with silencers or mufflers where practicable.
- No radios or music should be played on site.
- Wherever possible, dead-weight rollers must be used rather than vibratory rollers/compactors.

At Gate 2, only high level noise assessments have been undertaken, with predicted baseline and estimated construction levels. This will be refined for Gate 3 with noise monitoring to be completed at the relevant receptor sites. Survey work is also proposed to understand the use of the reservoir waterbodies by the wintering bird

species. Further noise modelling will be required to evidence that noise levels can be reduced to a level considered insignificant for the overwintering bird populations.

If it is found that the above mitigation cannot achieve the desired noise reduction, the construction of the shafts will need to be undertaken outside the overwintering period to ensure no adverse effects on integrity. Construction works at the AWRP site near Kempton WTW cannot be achieved outside the wintering period, therefore, the construction programme and techniques will need to be reviewed to try and enable the noisiest works to be completed outside the wintering period, or a set of noise thresholds (taking account of weather conditions) under which works can be carried out. The British Association of Shooting and Conservation (BASC) severe weather warning provides for the suspension of shooting in prolonged cold weather (between November and February) to reduce disturbance to waterfowl. Adherence to these warnings, and a cessation of works on site, may be required if the more standard mitigation measures are insufficient to conclude no adverse effect.

4.3.2.3 Summary

Table 4-20 summarises the *informal* Stage 2 Appropriate Assessment of the potential for noise, vibration and visual disturbance from Mogden water recycling scheme to cause adverse effects on South West London Waterbodies SPA and Ramsar site.

Table 4-20 Summary of for noise, vibration and visual disturbance from Mogden water recycling scheme to cause adverse effects on South West London Waterbodies SPA and Ramsar site.

Parameter	Summary
Impact type	Impacts associated with noise, vibration and visual disturbance could have a direct impact on qualifying species of the South West London Waterbodies SPA and Ramsar if present.
Receptors	Overwintering gadwall and shoveler
Probability	The impact is likely to occur in the absence of mitigation measures due to the extent of the construction activities and the presence of qualifying features within the impacted area.
Magnitude	An exceedance of Natural England's 3 dB screening threshold has been identified at Compound/ Shaft 10 and 11 and at the AWRP to South West London Waterbodies SPA and Ramsar.
Extent	Changes in noise levels over the estimated baseline were found within 1.25km radius from each of the proposed construction work sites.
Duration	Construction of the AWRP will take approximately 27 months to complete, and is currently estimated to overlap with two overwintering periods. Construction of each of the shaft locations will take approximately 2 months, and will be undertaken consecutively rather than together.
Timing	Timing of construction is unknown at this stage.
Frequency	Once at shaft sites 10 and 11. Disturbance during construction of the AWRP could occur over two overwintering periods and will affect the same waterbody adjacent to the northern boundary of the AWRP site.
Reversibility	Reversible.
Mitigation	Mitigation measures should be considered at this stage to prevent adverse effects on site integrity. However, additional site specific noise monitoring is required to improve the accuracy of desk based noise impact assessments completed plus wintering bird surveys to understand distribution of qualifying features within the zone of influence. Where mitigation measures identified in Section 4.3.2.2 are not sufficient to avoid an adverse effect, timing of works will need to be considered at Gate 3 to avoid overwintering period (not possible for the AWRP), or a set of noise thresholds (including consideration of weather conditions) agreed with Natural England for the noisiest works.
Summary	No adverse effects on site integrity anticipated based on currently available information and with the implementation of mitigation measures.

4.3.3 Assessment of dust and air quality emissions

4.3.3.1 Construction of AWRP near Kempton WTW and Shafts 10 and 11

The following Compounds/ Shafts have been identified that are within 50 m of ecological receptors: Compound/ Shaft 10 and 11, and the AWRP site near Kempton WTW. Section 4.3.1.2 provides the baseline data for

autumn and wintering peak counts of gadwall and northern shoveler in Kempton Local Nature Reserve and Red House Reservoir.

Potential adverse effects from gas (NOx and particles (PM_{10}) emissions) and dust from earthworks have been identified where Compounds/shafts and infrastructure sites are within close proximity of open water supporting habitat. It is anticipated that the A308 could be used as the main haul route to access the AWRP site, and shaft sites in close proximity. Although not within 200 m of the South West London Waterbodies SPA and Ramsar, it does extend within 200 m of the Stain Hill Reservoirs which are likely to be functionally linked habitat.

Exceeding critical values[86] for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. This could impact on water quality and health/ extent of macrophytes which are a key food source for gadwall and northern shoveler.

This is relevant to the following attributes within the SACO for the South West London Waterbodies SPA bird features:

- Gadwall and northern shoveler - Supporting habitat (both within and outside the SPA): Air quality.
- Gadwall and northern shoveler - Supporting habitat (both within and outside the SPA): Water quality/ quantity.
- Gadwall and northern shoveler - Supporting habitat (both within and outside the SPA): Vegetation characteristics.

For standing open water habitat and canals that support northern shoveler, there is no comparable habitat with established critical load estimates available for atmospheric nitrogen deposition. The critical level of oxides of nitrogen is 30 µg NOx m³ annual mean[87]. As habitat sensitivity depends on nitrogen and phosphate limitation, site specific conditions need to be taken into consideration when addressing the potential impacts of air pollution. Freshwater waterbodies, like the South West London Waterbodies, are typically phosphate limited rather than nitrogen limited. Therefore, it is phosphate availability that controls the growth of macrophytes and algae.

Construction works associated with the AWRP site and Compound/ Shafts 10 and 11 are not anticipated to affect phosphate availability within any component of the SPA/ Ramsar site or its supporting waterbodies. In addition, the impact of construction works on pollutant deposition rate and emission concentrations within the European site are anticipated to be short term, temporary and reversible in nature, and unlikely to result in any long term, adverse effects on critical loads and levels identified. However, air quality modelling of emissions has not been completed for Gate 2, and therefore there is uncertainty as to whether the 24hr critical loads will be exceeded. As such, further assessment will be carried out for Gate 3 to address this uncertainty.

Therefore assuming the precautionary principle, additional mitigation measures are required to prevent adverse effects as a result of dust and air quality emissions.

4.3.3.2 Mitigation measures

The following medium risk dust mitigation measures[88] should be considered to reduce the potential adverse effects of dust emissions on supporting habitat such as decaying wood and woodland habitat:

- Planning site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Ensure all vehicles switch off engines when stationary - no idling vehicles;
- Ensuring an adequate water supply for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- Reuse and recycle waste to reduce dust from waste materials;
- Ensure water suppression is used during demolition operations;

[86] Available from the Air Pollution Information System (APIS). Accessed at http://www.apis.ac.uk/.

[87] APIS (2021). South West London Waterbodies SPA. Air Pollution Information System. Accessed from: http://www.apis.ac.uk/srcl/select-a-feature?site=UK9012171&SiteType=SPA&submit=Next

[88] Institute of Air Quality Management IAQM (2017) Guidance on the Assessment of Dust from Demolition and Construction v1.1

- Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport;
- Ensuring all vehicles switch off engines when stationary - no idling vehicles; and
- Avoiding site runoff of water or mud.

4.3.3.3 Summary

Table 4-21 summarises the *informal* Stage 2 Appropriate Assessment of the potential for dust and traffic emissions caused by the Mogden water recycling scheme to lead to adverse effects on European sites and associated qualifying features**.**

Table 4-21 Summary of the potential for dust and air quality emissions caused by the Mogden water recycling scheme to lead to adverse effects on the South West London Waterbodies SPA and Ramsar qualifying features

Parameter	Summary
Impact type	Impacts associated with dust and traffic/NRMM emissions from construction activities could have an indirect impact on supporting habitat of qualifying species of the South West London Waterbodies SPA and Ramsar site.
Receptor	Overwintering bird populations; gadwall and northern shoveler
Probability	The impact is likely to occur in the absence of mitigation measures due to the extent of the construction activities and proximity of some haul routes to the supporting habitat within the impacted area.
Magnitude	The potential air quality impacts on ecological receptors were considered within a 200 m radius from the construction footprint. The risk of air quality impacts on ecological receptors present within 20 m was classified as major for earthworks and construction of shafts.
Extent	Up to 200m radius around construction sites and haul roads.
Duration	It is anticipated that construction works at the AWRP site will take approximately 27 months to complete.
Timing	Timing of construction is unknown at this stage.
Frequency	Frequent during 27 month construction period.
Reversibility	Uncertain – further air quality modelling is required to understand exceedance of critical loads on the supporting habitats. .
Mitigation	Best practice dust mitigation measures to ensure minimal dust emissions. Emissions from traffic (HGVs, plant) and NRMM will require further evaluation and modelling before mitigation can be fully defined.
Summary	No adverse effects on site integrity anticipated with the implementation of dust mitigation measures. Further assessment required to confirm suite of mitigation measures required to ensure no adverse effect on site integrity from traffic/plant/NRMM emissions.

4.4 TEDDINGTON DRA SCHEME

4.4.1 Baseline

4.4.1.1 Richmond Park SAC

Richmond Park SAC is situated in south- west London enclosed by densely settled suburbs including Kingston, Putney, Richmond and Wimbledon. It is one of the largest open spaces in Greater London and the largest of the Royal Parks. The parkland supports many ancient and veteran trees, particularly oak, which host a significant assemblage of invertebrates associated with dead and decaying wood and the SAC is one of four primary sites in England for the stag beetle *Lucanus cervus*, a globally threatened species[89] .

[89] Natural England (2016) European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features Richmond Park Special Area of Conservation (SAC) Site code: UK0030082

The stag beetle is the UK's largest terrestrial beetle and amongst the most spectacular, reaching 7 cm in length. Featuring shiny chestnut-violet wing-cases, the stag beetle is characterised by possessing large mandibles (jaws) which are antler-shaped in the male, giving them their common name. These 'antlers' are used for fighting other males, whereas the female's mandibles, being smaller, are more powerful.

The stag beetle requires decaying wood to complete its lifecycle. Its eggs are laid underground in the soil next to logs or the stumps of dead trees (typically apple *Malus* spp., elm *Ulmus* spp., lime *Tilia* spp., beech *Fagus sylvatica* and oak *Quercus* spp.). The beetle larva (or grub) will spend up to seven years in the wood, slowly growing in size. Timber is also utilised, especially sunken fence posts. Adult stag beetles emerge from mid-May until late July. Males emerge earlier to actively search for females to mate, and can often be seen flying on sultry summer evenings an hour or two before dusk. As adults, they are short-lived and generally die after mating, although occasionally some may over-winter in places such as compost heaps.

In order to assess the potential for stag beetles to be present within the footprint of the works, the outcomes of a study that used radio-telemetric monitoring to assess the dispersal capacity of stag beetles[90] was used to inform the Stage 2 Appropriate Assessment of the potential adverse effects of Teddington DRA. Based on monitoring results, we have applied a maximum dispersal distance of 1 km for stag beetles. Maximum female dispersal distance was recorded at 727 m and males' maximum dispersal distance was 2 km. However, the colonization of new nest sites is dependent on reproductive female presence and availability of deadwood habitat. Adopting a precautionary approach, the maximum dispersal distance in this Stage 2 Appropriate Assessment is assumed to be 1 km. In addition, once stag beetles have mated, females return to the spot where they emerged (if there is enough rotting wood to feed their young)[91]. This behaviour limits their dispersal and would result in stag beetle populations being largely restricted to the applicable European site.

The citations of non-statutory sites within 2 km of Richmond Park SAC were also reviewed. The citation for Richmond Park and Associated Areas Site of Importance for Nature Conservation (SINC) states that stag beetles are common at the site which extends beyond the boundaries of Richmond Park SAC into Ham Common. Therefore, the SINC provides functionally linked habitat to the stag beetle population at Richmond Park SAC. Richmond Park and Associated Areas SINC is approximately 700 m from the intake and 950 m from Shaft/ Compound 7. Greenspace Information for Greater London and National Biodiversity Network both have received recent records (2019 – 2021) of stag beetle in the area. Therefore, there is potential for stag beetle to be present during construction works. In addition, during the PEA of Ham Lands[92], piles of wood were recorded that could support stag beetle although it is unclear if these were being removed and adequately decaying.

4.4.2 Assessment of habitat loss, direct mortality and disturbance

4.4.2.1 Construction of Shaft 7, Intake and Outfall

Suitable habitat consisting of lowland mixed deciduous woodland and other broadleaved woodland has been identified within the footprint of Shaft/ Compound 7 and the intake location. This could be providing functionally linked habitat for stag beetle populations associated with Richmond Park SAC. Based on the dispersal capacity of stag beetles (estimated 1 km) and confirmation of stag beetle records at Richmond Park and Associated Areas SINC via the citation and Ham Lands SINC and records received by local records centres, there is potential for stag beetle to be present during construction works. Therefore, the proposed construction works could lead to habitat loss of functionally linked habitat, mortality/ injury and disturbance of stag beetle.

This is relevant to the following attributes of the SACO for Richmond Park SAC:

- Population abundance.
- Supporting habitat: structure/ function of decaying-wood habitat.
- Supporting habitat: structure/ function of woodland habitat structure.

Due to the lack of optimal supporting habitat within the footprint of the works (decaying wood matter and continuous woodland habitat) and short period of time that stag beetle disperse from May – August, adverse

[90] Rink, M. and Sinsch, U. (2007) Radio-telemetric monitoring of dispersing stag beetles: implications for conservation. *Journal of Zoology*, 272 (3), pp. 235-243

[91] https://ptes.org/campaigns/stag-beetles/stag-beetle-facts/

[92] Jacobs (2022). Teddington DRA: Ham Lands Preliminary Ecological Appraisal. Report for Thames Water Utilities Ltd, 1 – 38. B22849BM/REP/PEA/004.

effects on site integrity of Richmond Park SAC are deemed unlikely. However, further survey work and mitigation measures are required to reduce uncertainty.

4.4.2.2 *Mitigation measures*

Due to uncertainties regarding the presence of a stag beetle population within the footprint of proposed construction for Compound/ Shaft 7, intake and outfall additional invertebrate surveys are recommended at Ham Lands SINC and within woodland to be lost for the outfall infrastructure and connection to the Thames Lee Tunnel during Gate 3.

This will determine presence/likely absence and therefore, confirm if mitigation measures are required during construction.

Assuming stag beetle are present, the following mitigation measures should be considered:

- Invasive construction works that result in habitat loss should avoid May – August period as the most sensitive months that stag beetle disperse.
- Trees and/ or decaying wood removal should be avoided during construction where possible.
- Any impacted suitable dead wood habitat should be carefully moved to a suitable pre-identified receptor site in advance of construction works.
- Habitat enhancement in the form of additional log piles should be considered.

4.4.2.3 *Summary*

Table 4-22 summarises the *informal* Stage 2 Appropriate Assessment of the potential for habitat loss, direct mortality and disturbance to lead to adverse effects on stag beetle as a result of Teddington DRA scheme.

Table 4-22 Summary of the potential for supporting habitat loss, direct mortality and disturbance of stag beetle that could lead to adverse effects associated with Teddington DRA.

Parameter	Summary
Impact type	Impacts associated with habitat loss, mortality and disturbance could have a direct impact on qualifying species of Richmond Park SAC.
Receptor	Stag beetle
Probability	Male stag beetles are at risk of direct mortality and injury during dispersal from May – August. Therefore, the probability of mortality and injury is deemed low.
Magnitude	The habitat present within the footprint of the proposed scheme has potential to support stag beetle, however, is not deemed to be optimal habitat. Piles of wood were found in Ham Lands Site of Importance for Nature Conservation (SINC) but uncertainty as to whether they are in an adequate state of decay and/ or were being removed. High level of impact anticipated if stag beetles are present within the footprint of the works as this could lead to mortality.
Extent	The proposed intake on the River Thames will be require an approximate construction area of 5,000 m² and the proposed outfall will require a construction area of 2,500 m². The proposed size of the temporary compound site/ construction area for Shaft 7 is 2000 m².
Duration	During the construction phase, it is anticipated that the construction of the 7 tunnel sections and the 8 shafts would progress for a duration of 82 weeks. This is equivalent to 1.5 years assuming that each of the activities are undertaken sequentially and not ongoing at the same time. In addition, it is anticipated that construction works for the intake will take 13 months and the outfall 10 months. No specific timescale for construction of each shaft site and installation of the pipeline via pipe-jack has been provided.
Timing	Timing of construction is unknown at this stage.
Frequency	Once during construction.
Reversibility	N/A
Mitigation	• Trees and/ or decaying wood removal should be avoided during construction where possible. • Any impacted suitable dead wood habitat should be carefully moved to a suitable pre-identified receptor site in advance of construction works.
Summary	No adverse effects on site integrity anticipated with the implementation of mitigation measures.

4.4.3 Assessment of dust and air quality emissions

4.4.3.1 Construction of Shaft 7, Intake and Outfall

Exposure of decaying wood and woodland to dust emissions could cause deterioration of suitable supporting habitat for stag beetle. Lowland deciduous woodland has been identified within 20 m of earthworks at Compound/ Shaft 7 and the intake site, although the presence of stag beetle populations is uncertain. Supporting habitats could therefore potentially be exposed to dust emissions during construction of Compound/Shaft 7 and the intake and outfall. It is anticipated that Petersham Road could be used as the main haul route to access the intake and outfall. This passes directly adjacent to the Richmond Park SAC for a short section.

Unlike Epping Forest SAC, which is also designated for stag beetle, Richmond Park SAC does not have a specific attribute or target relating to air quality[93]. The Site Improvement Plan states that there are no current issues affecting the qualifying features[94]. There is also not an attribute or target listing the role of off-site supporting habitat. This suggests areas such as Ham Common and the area along the bank of River Thames which will be impacted by the Teddington DRA scheme are not of significance in supporting the stag beetle populations. As such, the risk from dust and traffic/plant/NRMM emissions resulting in an adverse effect on integrity is considered unlikely.

4.4.3.2 Mitigation measures

Best practice measures including hoarding around the site and dust suppression measures should be used as standard during construction. Additional mitigation to avoid and adverse effect on site integrity, based on the above assessment, is not required.

4.4.3.3 Summary

Table 4-23 summarises the *informal* Stage 2 Appropriate Assessment of the potential for dust emissions caused by the Teddington DRA scheme to lead to adverse effects on European sites and associated qualifying features.

Table 4-23 Summary of the potential for dust emissions caused by the Teddington DRA scheme to lead to adverse effects on European sites and associated qualifying features.

Parameter	Summary
Impact type	Impacts associated with dust emissions construction activities could have an indirect impact on off-site supporting habitat of qualifying species of Richard Park Special Area of Conservation (SAC).
Receptor	Stag beetle
Probability	Unlikely (no significant value attached to off-site habitat to support stag beetle populations)
Magnitude	The potential air quality impacts on ecological receptors were considered within a 200 m radius from the construction footprint. The risk of air quality impacts on ecological receptors present within 20 m was classified as major for earthworks and construction of shafts.
Extent	Up to 200m radius around construction sites and haul roads.
Duration	Construction of the intake and outfall will take approximately 12 months to complete.
Timing	Timing of construction is unknown at this stage.
Frequency	Once during construction, no further impacts.
Reversibility	Reversible.
Mitigation	None required.
Summary	No adverse effects on site integrity anticipated.

[93] Natural England (2016) European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features Richmond Park Special Area of Conservation (SAC) Site code: UK0030082.

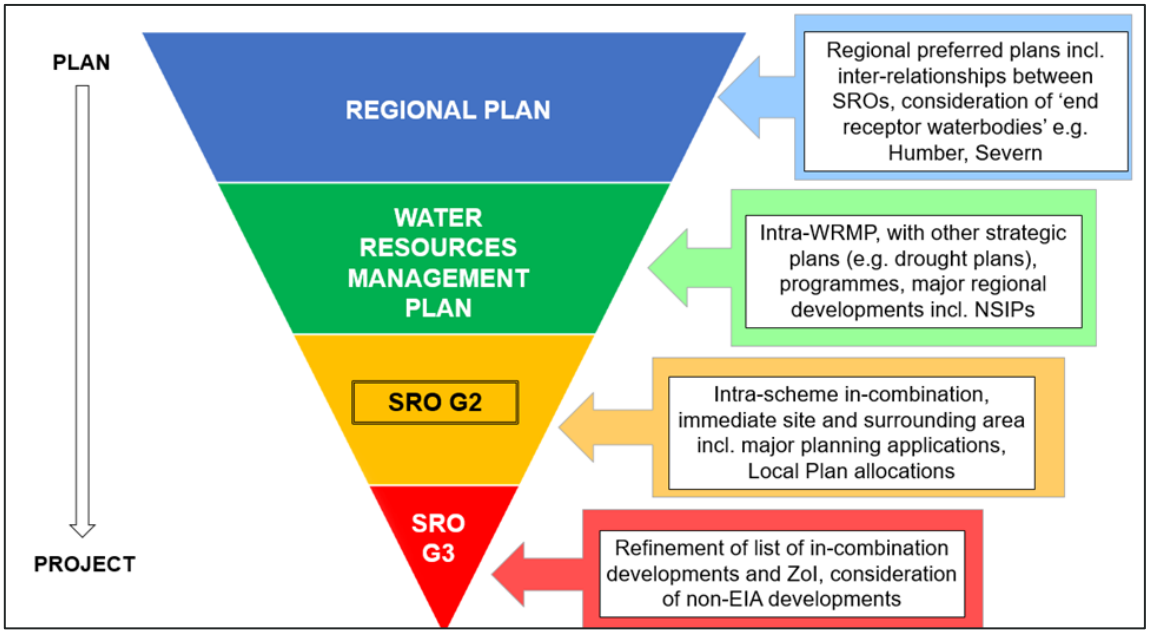
[94] Natural England (2014) Improvement Programme for England's Natura 2000 Sites (IPENS)Site Improvement Plan Richmond Park.

5. IN-COMBINATION ASSESSMENT

The in-combination assessment followed the approach outlined in a guidance note[95], originally presented to the NAU for comment by the Thames Water SRO teams in February 2022. The latest version of the note was circulated on 5th April 2022, with a subsequent meeting with the NAU leads to formally agree its adoption for the SRO process. Figure 5-1 presents a high-level overview of the approach to be taken, although this will reflect any further updates to the overarching methodology as required.

Therefore, as described, this HRA report considers only the in-combination effects in terms of local and site-specific information including large development allocations within Local Plans and larger planning applications.

Figure 5-1 Proposed responsibility for completion of in-combination assessment Regional Plans, Water Resources Management Plan and Strategic Resource Options.



The latest conclusions of the WRSE Regional Plan and WRMP24 water resources modelling reconciliations suggest that the London Effluent Reuse SRO will be built out in the following order:

- Teddington DRA scheme – construction c.2027 for operation by c.2030/31
- Beckton water recycling scheme – paused until c.2040.
- Mogden water recycling scheme – not currently required within the WRSE and WRMP24 modelling.

As such, the in-combination assessment has been proportionate and focussed on the Teddington DRA scheme, as that scheme will be built out within the timescale of the currently submitted local authority planning applications. Larger Nationally Significant Infrastructure Projects (NSIPs) and Local Plan allocations have been considered for the Beckton water recycling scheme and Mogden water recycling schemes as these have longer planning timescales, whilst the assessment has gone further for Teddington DRA scheme by reviewing major planning applications on the relevant council's website.

Note that the in-combination assessments will be revisited at Gate 3 based on refinement of the scheme design and to incorporate all relevant plans and projects at the time of writing.

5.1 INTER-SRO IN-COMBINATION EFFECTS

A 1 km ZoI has been used to reflect the overarching guidance produced for the Regional Plan, WRMP24 and SRO process[95] and to initially capture a search area for developments and plans. The Beckton water recycling scheme is located within six London boroughs: Enfield, Haringey, Waltham Forest, Redbridge, Newham and,

[95] Mott Macdonald (2022). Gate 2 Environmental Appraisal. Cumulative Effects Methodology.

Barking and Dagenham. The Mogden scheme is within Hounslow, Richmond upon Thames and Spelthorne. The Teddington DRA scheme is within Hounslow, Richmond upon Thames and Kingston upon Thames.

Planning applications, including NSIPs and Local Plan allocations within these boroughs were assessed to determine whether any within the ZoI could affect the same European sites as London Effluent Reuse schemes and therefore, could cause an in-combination effect during construction and/ or operation, which would require additional mitigation. Further assessment will be required as each scheme progresses through Gate 3 and the planning and Environmental Impact Assessment stage.

5.1.1 Planning Inspectorate's Programme of Projects

5.1.1.1 Southampton to London Pipeline Project[96]

The Southampton to London Pipeline (SLP) project is replacing 90 km of the underground fuel pipeline between Boorley Green, Hampshire and the West London Terminal storage facility in Hounslow. Construction works to install the replacement pipeline began in late 2021 and are estimated to be completed in 2023. As such, no in-combination effects are anticipated, with the earliest London Effluent Reuse SRO scheme commencing in 2027.

5.1.1.2 River Thames Scheme[97]

A new river channel is to be built in two sections between Egham Hythe in Runnymede and Shepperton in Spelthorne; capacity improvements to existing river structures (including at Sunbury, Molesey and Teddington Weirs and Desborough Cut); new green open spaces; habitat creation and enhancement; active travel provision and associated development.

Planning applications have been submitted and the ZoI overlaps with the Mogden water recycling scheme and Teddington DRA scheme. There are no European sites which would be affected by any changes in flow or water quality during the operational phases of both schemes.

However, construction of the River Thames Scheme is estimated to commence in 2027, which would overlap with the earliest London Effluent Reuse SRO scheme commencing; currently considered to be the Teddington DRA scheme. However, given the locality of both schemes, the same European sites are not affected.

If Mogden water recycling scheme were to be selected for earlier construction, albeit considered unlikely on the basis of the water resource modelling, in-combination effects from traffic emissions on the South West London Waterbodies SPA and Ramsar would need to be considered further.

5.1.1.3 North London Heat and Power Project[98]

The current EcoPark in Edmonton will reach capacity in 2025, as such the redevelopment of the park to include an Energy Recovery Facility, generating electricity using residual waste as a fuel and capable of an intended electrical output of around 70 MW, is underway.

The scheme is within the ZoI of the Beckton water recycling scheme. Therefore, there is potential for in-combination effects on the Lee Valley SPA and Ramsar during construction. However, construction of the Energy Recovery Facility commenced in 2019 and with the facility due to be operational in 2025, there is unlikely to be any overlap with the Beckton water recycling scheme.

5.1.2 Transport and Works Act (TWA) applications and decisions

There are currently no transport and Works Act (TWA) applications and decisions associated with the ZoI, hence no-combination impacts are expected

5.1.3 Local Planning Authority land allocations (from Local Plan) and planning applications: Teddington DRA scheme

Table 5-1 identifies the latest planning applications and Local Plan allocations which need to be considered for an in-combination effect with the Teddington DRA scheme. Only large existing and emerging Local Plan allocations e.g. 500 or more dwellings and large Town and Country Planning applications, where an EIA is

[96] Southampton to London Pipeline Project (slpproject.co.uk)
[97] https://www.riverthamesscheme.org.uk/
[98] http://northlondonheatandpower.london/

required, have been considered. Further refinement of the in-combination assessment will be required at Gate 3.

Table 5-1 Teddington DRA scheme: Schedule of developments for in-combination effects assessment

No.	Application reference	Planning Authority	Applicant and brief description	Closest distance from scheme boundary and orientation	Planning status	Overlap in temporal scope?	Potential for in-combination effects?
1	N/A	London Borough of Hounslow	Isleworth – 174 Twickenham Road: This site has been identified through the London SHLAA 2013 as it has a potential housing capacity during the plan period.	450 m to the north east	Land Allocation	N – This is not likely; however, this cannot be certain as no planning applications have currently been accepted for this site.	No – there are no European designated site which would be affected by both schemes.
2	N/A	London Borough of Hounslow	Isleworth – Swan Court: The mixed-use allocation is based on a floorspace ratio of 50:50 residential to office use. This site has been identified through the London SHLAA 2013 as it has a potential housing capacity during the plan period. Proposals for the site should also include an element of office floorspace.	900 m to the north east	Land Allocation	N – This is not likely; however, this cannot be certain as no planning applications have currently been accepted for this site.	No – there are no European designated site which would be affected by both schemes.
3	N/A	London Borough of Hounslow	Isleworth – Rugby Road: The mixed-use allocation is based on a floorspace ratio of 50:50 residential to commercial uses. The site has been identified through the London SHLAA 2013 as it has a potential housing capacity during the plan period. Proposals for light industrial uses (B1b/c) should safeguard the residential amenity in the remaining areas of the site.	500 m to the west	Land Allocation	N – This is not likely; however, this cannot be certain as no planning applications have currently been accepted for this site.	No – there are no European designated site which would be affected by both schemes.
4	N/A	London Borough of Hounslow	Isleworth – Nazareth House: This site has planning permission for residential with large proportion for care home provision. Residential development will enable the preservation and enhancement of the listed buildings on site.	720 m to the north east	Land Allocation	N – This is not likely; however, this cannot be certain as no planning applications have currently been accepted for this site.	No – there are no European designated site which would be affected by both schemes.
5	22/1168/FUL	London Borough of Richmond	Richmond upon Thames College: Alterations and extension to existing Sports Hall including associated landscaping within the Tech Hub	920 m to the west	In Progress (Decision due: 22/07/2022)	Y – A decision is yet to be made on the development. By the time the application is approved there is a	No. There is no evidence of stag beetle on the site, although provision of loggeries is being

No.	Application reference	Planning Authority	Applicant and brief description	Closest distance from scheme boundary and orientation	Planning status	Overlap in temporal scope?	Potential for in-combination effects?
		upon Thames	Development Zone to replace Tech Hub building as defined under application 15/3038/OUT, and erection of Sports Hall with associated car parking, landscaping, and other works within the Main College Development Zone including erection of STEM building as approved under application 19/2517/RES.			possibility it's construction timescale could overlap with the LRU scheme.	made as part of the overarching scheme. The site is >1km from an SAC supporting stag beetle, and HGV/vehicle movements will be along the A316 Chertsey Road and unlikely to be routed along the A307 where in-combination vehicle movements with Teddington DRA could occur.
6	Not validated	London Borough of Richmond upon Thames	Ham Close: The demolition of the existing buildings on-site and phased mixed-use development comprising 452 residential homes (Class C3) up to six storeys a Community/Leisure Facility (Class F2) of up to four storeys in height, a "Makers Lab" (sui generis) of up to two storeys together with basement car parking and site wide landscaping.	400 m to the east	Consultation stage	Y – consultation began back in 2015 and is expected to come to an end in 2022. A timetable has not yet been set for this development.	Uncertain, both developments are likely to require HGV/vehicle movements along the A307 Petersham Road and in proximity to Richmond Park SAC, however construction timescales are uncertain. Richmond Park SAC does not have an air quality attribute or target, nor does the Site Improvement Plan identify any issues affecting the site. As such, in-combination air quality issues are considered low risk.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY OF EFFECTS

The *informal* Stage 1 Screening has been updated between Gate 1 and Gate 2 to reflect the refinement of the conveyance routes, and further modelling undertaken to support the assessment of noise disturbance, dust and air quality issues, hydrodynamic and water quality changes. Notably, between Gate 1 and Gate 2, work on the Mogden South Sewer and Beckton water recycling scheme pipeline route were paused, and therefore assessment work for these schemes is not included in the report.

The *informal* Stage 1 Screening concluded the following LSEs:

- Beckton water recycling scheme – construction impacts on Lee Valley SPA and Ramsar, construction and operation impacts on functionally linked habitat to the Thames Estuary and Marshes SPA and Ramsar.
- Mogden water recycling scheme – construction impacts on the South West London Waterbodies SPA and Ramsar.
- Teddington DRA scheme – construction impacts on the Richmond Park SAC.

Further consideration has been given to the loss of habitat within the boundary of the Lee Valley SPA and Ramsar due to the construction requirements at Thames Water's Lockwood site. Historic imagery has shown the area in question to always consist of short grassland, and therefore it is unlikely to have ever been supporting habitat for the bird species using the site, given their preference for open water/marginal habitats. As such, it has been concluded that it provides no structural or functional role to the species, and as such its loss, albeit with mitigation to avoid degradation of the habitats surrounding the waterbodies, is not considered to be an adverse effect.

Refinement of the intake and outfall locations associated with the Teddington DRA scheme led to the Richmond Park SAC being screened in during Gate 2. Suitable habitat consisting of lowland mixed deciduous woodland and other broadleaved woodland has been identified within the footprint of some structures, and could provide functionally linked habitat for stag beetle populations associated with the Richmond Park SAC. A lack of data, including site specific surveys, means there is uncertainty over the potential use of this habitat and therefore further work is required to resolve this ahead of Gate 3. The area of habitat to be lost is considered to be small, and potential mitigation measures available to ensure no adverse effect.

The noise and air quality assessments undertaken to determine the potential risk of impact from construction activities when in proximity to the European sites has been used within the *informal* Stage 2 Appropriate Assessments. Adverse effects are identified and therefore additional mitigation has been recommended. However, these assessments have been high level for Gate 2, and therefore refinement and additional air quality modelling will be required ahead of Gate 3. The effectiveness of the proposed mitigation measures will also need to be further evidenced in the Gate 3 project-level HRA.

The in-combination assessment has focussed on the anticipated scheme being required earliest, as per WRSE and WRMP24 modelling outputs; Teddington DRA scheme. There are currently no Nationally Significant Infrastructure Projects, Local Plan allocations or lodged planning applications that would result in in-combination effects. This will be reviewed as the project-level HRA is developed in Gate 3. As the Beckton water recycling scheme and Mogden water recycling scheme are unlikely to be required as early, the projects against which these will need to be assessed will have changed significantly, and therefore this will be revisited when the schemes are progressed to Gate 3.

6.2 RECOMMENDATIONS FOR GATE 3

The following recommendations for future survey work at Gate 3 have been made due to uncertainties identified during the *informal* Stage 2 Appropriate Assessment completed at Gate 2:

- Beckton water recycling scheme
    - Overwintering bird surveys along Barking Creek to determine species presence, abundance and distribution on saltmarsh and mudflat priority habitat and within watercourse itself. This is recommended due to a lack of bird survey data in Barking Creek (not surveyed by WeBS) and potential for the area to provide functionally linked habitat to qualifying species of the Thames

Estuary and Marshes SPA and Ramsar site. Distribution maps could be reviewed alongside noise impact assessment outputs to determine species typically present within the ZoI, and further assessment on species' sensitivity based on approximate noise levels could be undertaken.

  - Overwintering bird surveys at Walthamstow Reservoirs (specifically Warwick Reservoir East, Reservoir No. 1, 2 and 5, Low Maynard Reservoir and Lockwood Reservoir) in association with Compound/ Shaft 5 and 6 to determine the abundance and distribution of qualifying features within each reservoir. Distribution maps could be reviewed alongside noise impact assessment outputs to determine species typically present within the ZoI, and further assessment on species' sensitivity based on approximate noise levels could be undertaken.

- Mogden water recycling scheme
  - Overwintering bird surveys at Kempton Local Nature Reserve and Red House Reservoir in association with Compound/ Shaft 10 and 11 to determine the abundance and distribution of qualifying features within each reservoir. Distribution maps could be reviewed alongside noise impact assessment outputs to determine species typically present within the ZoI, and further assessment on species' sensitivity based on approximate noise levels could be undertaken.
- Teddington DRA scheme
  - Invertebrate surveys within the boundary of Ham Lands SINC with a focus on stag beetle presence, abundance and distribution, in order to determine if the deciduous woodland and wood piles present support stag beetles and provide functionally linked habitat for Richmond Park SAC. This will inform appropriate mitigation measures for the construction of Compound/ Shaft 7, the intake and outfall associated with Teddington DRA scheme.

Appendix 1 Noise assessment approach

TERMINOLOGY

Sound levels are measured in decibels (dB). The decibel scale is logarithmic rather than linear. A noise level change of 3 dB on a sound meter reading would be just perceptible by humans, and an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequencies. The ear "hears" high frequency sound of a given level more loudly than low frequency sound of the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second. It is impractical to specify the sound level for each second and so time averaging is required. In practice, human response to sound is related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of the assessment these include:

- $L_{Aeq,T}$ the equivalent A-weighted continuous sound level over period T. This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hr for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period. The unit is used for assessing traffic, transportation and industrial noise for planning purposes.
- L_{Amax} the maximum A-weighted sound level over a period of measurement. This unit is used for assessing the potential effect on sleep disturbance of individual events at night, such as aircraft, train movements or impulsive industrial activities.

RECEPTOR SITES

The construction noise calculations will be used to indicate noise levels at key receptor sites, within a radius of approximately 1.25 km[99] of the London Effluent Reuse SRO schemes. The receptor sites include a range of designations, including SPA, Ramsar, SSSI (sites with ornithological features) and WeBS bird count sectors, surveyed by the BTO.

DISTURBANCE THRESHOLDS

There are no standards for the assessment of noise affecting ornithological receptors. Previous studies have sought to understand how different ornithological receptors may respond to different disturbance stimuli. For example, a 2009 Institute of Estuarine and Coastal Studies (IECS) report[100] gives an illustrative overview of the effects of disturbance to non-breeding waterbirds based on observations made during the construction of the South Humber Power Station. Scottish Natural Heritage also undertook a study in 2007 looking at disturbance, both noise and visual, to a range of bird species including waterbirds and raptors[101].

The IECS have since produced a 'Waterbird Disturbance Mitigation Toolkit' in 2013 to further assist developers in relation to disturbance impacts on non-breeding waterbirds arising from construction works within or adjacent to European sites (e.g., Special Protection Areas and Ramsar Sites)[102]. The toolkit recognises and provides a simple screening criteria for developments. Disturbance stimuli 'at the bird' were separated into three effect levels:

- **High Level Disturbance Stimuli:** Sudden single noise of over 60 dBA (at the bird) / - Continuous/repetitive noise over 72 dBA (at the bird) in an environment not previously disturbed;
- **Moderate Level Disturbance Stimuli:** Sudden noises of 55-60 dBA (at the bird) / Continuous/repetitive noises 60-72 dBA (at the bird); and
- **Low Level Disturbance Stimuli:** Noise of less than 55dB (at the bird) / Noise of 55-72 dBA (at the bird) in a highly disturbed environment e.g., with background ambient noise levels of >60 dBA.

[99] Based on initial noise calculations, a change above the baseline noise level is not detected at a greater distance than 1.1km.

[100] Cutts, N., Phelps, A. and Burdon, D. (2009) Construction and waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA, Institute of Estuarine and Coastal Studies, University of Hull.

[101] 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.

[102] https://www.tide-toolbox.eu/tidetools/waterbird_disturbance_mitigation_toolkit/

Natural England has advised on other developments that a threshold of 70 dB is no longer acceptable as a blanket threshold, and regard should be had to the change in noise level over the baseline as a result of the development.

It is understood that Natural England has an internal document advising on how to assess noise disturbance; '*A Review of the Effects of Noise on Birds*' (2018). Although not available to project teams or consultants, it is understood from discussions with various Natural England case officers that the following principles apply, and these have been used in the *informal* Stage 1 Screening of the receptor sites.

With regards to impulsive/sporadic events, the document states the following:

- In the case of sporadic noise, a greater than 3 dBA increase in peak noise might be a useful and sufficiently precautionary rule-of-thumb when considering the likelihood of a significant effect.
- With regards to continuous noise sources, the document states that as a rule of thumb, increases of 3dB or more against existing levels could be significant.

NOISE CALCULATIONS

Values of $L_{Aeq,T}$ and L_{Amax} will be predicted and ambient $L_{Aeq,T}$ levels have been estimated. Baseline noise levels have been derived from publicly available Environmental Statement noise chapters from developments within the immediate area and/or professional judgement.

In accordance with the methodology presented in BS5228-1 (the code of practice for noise and vibration control on construction and open sites), the potential noise levels generated during construction have been predicted by determining an appropriate source level for each item of construction plant and equipment (based on the sound pressure level at a distance of 10 m) and correcting it for:

- Distance effects on noise attenuation between source and receptor;
- Percentage operating time of the construction machinery;
- Barrier screening effects on noise attenuation;
- Ground absorption effects on noise attenuation;
- Facade corrections for noise reflection; and
- Effects of embedded mitigation measures (i.e. those included regardless of European site consideration).

It is recognised that the procedure is an estimation process, as the precise details of day-to-day plant usage, noise emission and working patterns are not known at this stage. However, historical data on noise from specific construction activities are available, and the location of receptor sites relative to the construction works are also known.

Meteorological conditions can affect the propagation of sound, particularly over longer distances, thus the construction noise calculations will take account of worst-case conditions whereby the receptor is assumed to be at a downwind location relative to the source.

The calculations have been carried out using a BS5228-1 spreadsheet which follows the prescribed calculation methodology for the propagation path between each item of plant at the source activity location and each receptor site. Annex F of BS5228-1 provides equations for distance attenuation, soft ground absorption correction, percentage on-time correction, barrier effects, and the summation of noise from a number of plant items.

The calculations have been based on plant assumptions made available by the project engineers, Jacobs, and the overarching construction programme for each SRO scheme, as detailed in the CDRs.

The results have been presented in a tabulated format where an increase in 3 dB has been highlighted to show change in noise levels from the construction of the SRO schemes.

Appendix 2 *Informal* Stage 1 Screening

Appendix 2 Stage 1 screening assessments of identified European sites within 10 km radius of the proposed London Effluent Reuse SRO for potential likely significant effects.

Designated site name:	**South West London Waterbodies (UK9012171)**	
Designation type: (SAC, SPA, Ramsar):	**SPA**	
Qualifying features:	056 *Anas clypeata;* Northern shoveler (wintering). 051 *Anas strepera*; Gadwall (wintering).	**Water Dependency** Species identified as water dependent: • 056 *Anas clypeata;* Northern shoveler • 051 *Anas strepera*; Gadwall
Current conservation status:	**056 *Anas clypeata;* Northern shoveler** (status: short term – increasing, long term – increasing; type: non-breeding, size: minimum – 853, maximum 853, represented 2.1% of the North West European population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 2 – 15%, isolation: population not-isolated within extended distribution range) **051 *Anas strepera*; Gadwall** (status: short term – increasing, long term – increasing; type: non-breeding, size: minimum – 710, maximum 710, represented 2.4% of the North West European population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 2 – 15%, isolation: population not-isolated within extended distribution range)	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site.	
SSSI Condition assessment:	Kempton Park Reservoirs SSSI: 100% Unfavourable - Recovering; Knight and Bessborough Reservoirs SSSI: 100% Favourable; Staines Moor SSSI: 96.16% Favourable, 2.13% Unfavourable - Recovering; Thorpe Park No.1 Gravel Pit SSSI: 100% Favourable; Wraysbury and Hythe End Gravel Pits SSSI: 100% Favourable; Wraysbury No. 1 Gravel Pit SSSI: 100% Favourable; and Wraysbury Reservoir SSSI: 100% Favourable.	
Site Improvement Plan:	1. Public access/ disturbance – Pressure/Threat – 051 Gadwall, 056 Shoveler – Produce written agreement with landowners and recreational users to reduce recreational disturbance. 2. Changes in species distributions – Pressure/Threat - 051 Gadwall, 056 Shoveler – In partnership with bird recorders/watchers, review existing data and secure fit-for-purpose recording practices across the SPA and its surroundings. 3. Invasive species – Pressure/Threat - 051 Gadwall, 056 Shoveler – Manage *Crassula helmsii* and equip recreational users and landowners to monitor for the plant. 4. Natural changes to site conditions – Pressure/Threat - 051 Gadwall, 056 Shoveler – Carry out strategic habitat management, including management of bankside vegetation. 5. Fisheries: fish stocking – Pressure - 051 Gadwall, 056 Shoveler – Secure appropriate fish stocking levels. 6. Inappropriate weed control – Threat - 051 Gadwall, 056 Shoveler – Clarify appropriate weed control with owners and tenants through consents and carry out enforcement action where necessary. 7. Invasive species – Threat - 051 Gadwall, 056 Shoveler – Research Egyptian geese and control if necessary.	

Potential Effects

London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Mogden water recycling scheme	This London Effluent Reuse scheme is located approximately 8.2 m east of South West London Waterbodies SPA at its closest point. A 1.6 – 1.8 m pipeline is proposed for installation using both trenched (open cut) and trenchless (2m diameter pipe jack) methods; pipe sections installed via open cut will be 1.6 m in diameter and pipe sections installed via pipe jack will be 1.8 m in diameter. Approximately 0.82 km of the pipeline to the east of Kempton Park East Reservoir (within the SPA), from Forge Lane Primary School to Hatherop Road Recreation Ground will be installed using open cut methods. From Hatherop Road Recreation Ground to the proposed new AWRP near Kempton WTW, the pipeline will be installed using a pipe jack to avoid disruption of the railway line. This section of the pipeline is approximately 14.2m south-east of Red House Reservoir (within the SPA). Relevant Site improvement Plan threats and pressures for this London Effluent Reuse scheme include (1) public access/ disturbance, (2) changes in species distributions, (3) invasive species and (4) natural changes to site conditions. During construction of the pipeline and new AWRP near Kempton WTW, northern shoveler and gadwall will be exposed to increased anthropogenic disturbance including noise, vibration and light (if night works proposed). As both northern shoveler and gadwall largely overwinter in the UK and non-breeding populations are present at the South West London Waterbodies SPA, timing restrictions could minimise potential disturbance impacts and changes to species distribution. However, LSEs cannot be ruled out at this stage due to the proximity and scale of this London Effluent Reuse scheme. In addition, potential impact pathways to site conditions have been identified including the damage or removal of deciduous woodland around the periphery of the SPA, potentially increasing exposure to anthropogenic disturbance and atmospheric pollution; although it is noted that deciduous woodland is not supporting habitat for northern shoveler and gadwall. There is also potential for the introduction/ spread of invasive and non-native species including swamp stonecrop (*Crassula helmsii*) and pollution incidents if best practice guidelines are not adhered to during construction. Installation of the pipeline could also impede natural groundwater supply, impacting on water levels of waterbodies associated with the SPA. Kempton Park East Reservoir was previously a water supply reservoir which has been redundant since 1980. To ensure compliance with the maximum water volumes for redundant reservoirs under the Reservoirs Act part of the earth and clay embankments were removed in 1996. Red House Reservoir remains operational as a water storage facility and is fed by the Staines Reservoirs Aqueduct. In addition, Knight and Bessborough Reservoirs are located downstream of the proposed discharge outfall (upstream of the existing Thames Water Walton water treatment works intake). The site is also an embanked water storage reservoir with controlled water supply. As the water levels are controlled at all three sites, the installation of the pipeline and discharge of a maximum 200 Ml/d of treated discharge into the River Thames will not impact on water depth in Kempton Park East Reservoir, Red House Reservoir and Knight and Bessborough Reservoirs. There is potential for long term water quality deterioration if the recycled water does not meet Water Framework Directive (WFD) water quality standards, specific water quality requirements of the qualifying features and long-term anthropogenic disturbance from the new AWRP near Kempton WTW. Therefore, LSEs on qualifying features of the SPA cannot be ruled out at the screening stage of this London Effluent Reuse scheme.	**Yes**	**N/A**

Designated site name:	South West London Waterbodies (UK9012171)		
Teddington DRA scheme	This London Effluent Reuse scheme is located 4.7 km north-east of the South West London Waterbodies SPA. Due to the distance between the proposed London Effluent Reuse scheme and designated site, and presence of northern shoveler and gadwall largely during the winter as non-breeding populations in the SPA (shortening exposure timescales), no noise, vibration or light disturbance impacts are anticipated during construction. All of the waterbodies of the SPA are hydrologically connected to the River Thames either via groundwater sources flowing through alluvial sands and gravels or pumped supply. However, due to the relatively low abstraction and discharge rate proposed (maximum 150 Ml/d) and location of the discharge outfall downstream of waterbodies within the SPA (upstream of Teddington weir), potential impacts on water depth (to gravel pits) and water quality (gravel pits and water supply reservoirs) are considered negligible. Therefore, no LSEs are anticipated.	**No**	**No**

Designated site name:	**South West London Waterbodies (UK11065)**	
Designation type: (SAC, SPA, Ramsar):	Ramsar	
Qualifying features:	**Ramsar criterion 6** Species/populations occurring at levels of international importance. Species peak count in spring/autumn: *Anas clypeata;* Northern shoveler (wintering) - 397 individuals, representing an average of 2.6% of the British populations (5 year peak mean 1998/9 – 2002/3). Species peak count in winter: *Anas strepera*; Gadwall (wintering) - 487 individuals, representing an average of 2.8% of the British population (5 year peak mean 1998/9 – 2002/3). Species currently occurring at levels of national importance: *Podiceps cristatus*; Great crested grebe *Phalacrocorax carbo*; Great cormorant *Aythya fuligula*; Tufted duck *Podiceps nigricollis nigricollis*; Black-necked grebe *Mergellus albellus*; Smew	**Water Dependency** Species identified as water dependent (excluding national importance): • *Anas clypeata;* Northern shoveler • *Anas strepera*; Gadwall
Current conservation status:	N/A	
Conservation objectives:	Information not currently available.	
SSSI Condition assessment:	Kempton Park Reservoirs SSSI: 100% Unfavourable - Recovering; Knight and Bessborough Reservoirs SSSI: 100% Favourable; Staines Moor SSSI: 96.16% Favourable, 2.13% Unfavourable - Recovering; Thorpe Park No.1 Gravel Pit SSSI: 100% Favourable; Wraysbury and Hythe End Gravel Pits SSSI: 100% Favourable; Wraysbury No. 1 Gravel Pit SSSI: 100% Favourable; and Wraysbury Reservoir SSSI: 100% Favourable.	
Site Improvement Plan:	Information not currently available.	

Potential Effects

London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Mogden water recycling scheme	This London Effluent Reuse scheme is located approximately 8.2 m east of South West London Waterbodies Ramsar site at its closest point. A 1.6 – 1.8 m pipeline is proposed for installation using both trenched (open cut) and trenchless (2m diameter pipe jack) methods; pipe sections installed via open cut will be 1.6 m in diameter and pipe sections installed via pipe jack will be 1.8 m in diameter. Approximately 0.82 km of the pipeline to the east of Kempton Park East Reservoir (within the Ramsar site), from Forge Lane Primary School to Hatherop Road Recreation Ground will be installed using open cut methods. From Hatherop Road Recreation Ground to the proposed AWRP near Kempton WTW, the pipeline will be installed using a pipe jack to avoid disruption of the railway line. This section of the pipeline is approximately 14.2 m south-east of Red House Reservoir (within the Ramsar site). During construction of the pipeline and new AWRP near Kempton WTW, northern shoveler and gadwall will be exposed to increased anthropogenic disturbance including noise, vibration and light (if night works proposed). As both northern shoveler and gadwall largely overwinter in the UK and non-breeding populations are present at the South West London Waterbodies Ramsar site, timing restrictions could minimise potential disturbance impacts and changes to species distribution. However, LSEs cannot be ruled out at this stage due to the proximity and scale of this London Effluent Reuse scheme. In addition, potential impact pathways to site conditions have been identified including the damage or removal of deciduous woodland around the periphery of the Ramsar site, potentially increasing exposure to anthropogenic disturbance and atmospheric pollution; although it is noted that deciduous woodland is not supporting habitat for northern shoveler and gadwall. There is also potential for the introduction/ spread of invasive and non-native species including swamp stonecrop (*Crassula helmsii*) and pollution incidents if best practice guidelines are not adhered to during construction. Installation of the pipeline could also impede natural groundwater supply, impacting on water levels of waterbodies associated with the SPA. Kempton Park East Reservoir was previously a water supply reservoir which has been redundant since 1980. To ensure compliance with the maximum water volumes for redundant reservoirs under the Reservoirs Act part of the earth and clay embankments were removed in 1996. Red House Reservoir remains operational as a water storage facility and is fed by the Staines Reservoirs Aqueduct. In addition, Knight and Bessborough Reservoirs are located downstream of the proposed discharge outfall (upstream of the existing Thames Water Walton water treatment works intake). The site is also an embanked water storage reservoir with controlled water supply. As the water levels are controlled at all three sites, the installation of the pipeline and discharge of a maximum 200 Ml/d of treated discharge into the River Thames will not impact on water depth in Kempton Park East Reservoir, Red House Reservoir and Knight and Bessborough Reservoirs. There is potential for long term water quality deterioration if the recycled water does not meet Water Framework Directive (WFD) water quality standards, specific water quality requirements of the qualifying features and long-term anthropogenic disturbance from the new AWRP near Kempton WTW. Therefore, LSEs on qualifying features of the Ramsar site cannot be ruled out at the screening stage of this London Effluent Reuse scheme.	**Yes**	**N/A**
Teddington DRA scheme	This London Effluent Reuse scheme is located 4.7 km north-east of the South West London Waterbodies Ramsar site. Due to the distance between the proposed Teddington DRA scheme and designated site, and presence of northern shoveler and gadwall largely during the winter as non-breeding populations in the Ramsar site (shortening exposure timescales), no noise, vibration or light disturbance impacts are anticipated during construction. All of the waterbodies of the Ramsar site are hydrologically connected to the River Thames either via groundwater sources flowing through alluvial sands and gravels or pumped supply. However, due to the relatively low abstraction and discharge rate	**No**	**No**

Designated site name:	South West London Waterbodies (UK11065)		
	proposed (maximum 150 Ml/d) and location of the discharge outfall downstream of waterbodies within the Ramsar site (upstream of Teddington weir), potential impacts on water depth (to gravel pits) and water quality (gravel pits and water supply reservoirs) are considered negligible. Therefore, no LSEs are anticipated.		

Designated site name:	**Richmond Park (UK0030246)**		
Designation type: (SAC, SPA, Ramsar):	**SAC**		
Qualifying features:	1063 *Lucanus cervus*; Stag beetle	**Water Dependency** Species not identified as water dependent.	
Current conservation status:	**1063 *Lucanus cervus*; Stag beetle: Favourable** (range: favourable; population: favourable (minimum 291, maximum 3500); habitat for the species: favourable; future prospects: favourable).		
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of the habitats of qualifying species • The structure and function of the habitats of qualifying species • The supporting processes on which the habitats of qualifying species rely • The populations of qualifying species, and, • The distribution of qualifying species within the site.		
SSSI Condition assessment:	Richmond Park SSSI: 100% Unfavourable – Recovering.		
Site Improvement Plan:	No current issues affecting the National Site Network feature have been identified on this site.		
Potential Effects			
London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Mogden water recycling scheme	This London Effluent Reuse scheme is located approximately 3.2 km north-west of Richmond Park SAC. No land take within the SAC boundary is proposed and there are currently no threats or pressures affecting the qualifying feature that are associated with the proposed works. The Mogden water recycling scheme is hydrologically connected to Richmond Park via Beverley Brook; a tributary of the River Thames. As the qualifying feature of the SAC (stag beetle) is not water dependent, potential changes in water quality from the discharge of recycled water upstream in the River Thames and reduction in wetted habitat via discharge reduction at Mogden STW, is not anticipated to significantly affect the stag beetle population. Therefore, no LSEs are anticipated from Mogden water recycling scheme.	**No**	**No**
Teddington DRA scheme	This London Effluent Reuse scheme is located approximately 1.2 km south-west of Richmond Park SAC. No land take within the SAC boundary. However, there is potential for functionally linked habitat to be present within the footprint of the proposed works (particularly Shaft/ Compound 7 and the intake along the River Thames where lowland mixed deciduous woodland is present and other broadleaved woodland, respectively). To determine the likely presence of stag beetle during the proposed works, a radio telemetric stag beetle monitoring study was reviewed. The study concluded that the colonisation of new stag beetle nest sites depended on the dispersal ability of females, as male dispersal was directed by reproductive females. The maximum dispersal distance recorded for female stag beetles was 727 m[103]. Adopting a precautionary approach, a 1 km buffer of Epping Forest SAC was used to identify potential functionally linked habitat. The citation for Richmond Park and associated areas Site of Importance for Nature Conservation (SINC) states that stag beetle are common at the site which extends beyond the boundaries of Richmond Park SAC into Ham Common. This is approximately 700 m from the intake and 950 m from Shaft/ Compound 7. Greenspace Information for Greater London (GiGL) records and National Biodiversity Network (NBN) both have received recent records (2019 – 2021) of stag beetle in the area. There is potential for stag beetle to be present during construction works. In addition, during the Preliminary Ecological Appraisal of Ham Lands[104], piles of wood were recorded that could support stag beetle although it is unclear if these were being removed. An impact pathway was also identified on supporting habitat of stag beetle during heavy goods vehicle movements to Shaft/ Compound, intake and outfall sites via Upper Ham Road which is adjacent to the boundary of the Richmond Park SAC. Construction vehicle emissions therefore need to be considered. The Teddington DRA scheme is hydrologically connected to Richmond Park via Beverley Brook; a tributary of the River Thames. As stag beetles are not water dependent, potential changes in hydrological regime and water quality during operation of the scheme are not anticipated to significantly affect the stag beetle population.	**Yes (uncertain)**	**N/A**

[103] Rink, M. and Sinsch, U. (2007) Radio-telemetric monitoring of dispersing stag beetles: implications for conservation. *Journal of Zoology*, 272 (3), pp. 235-243
[104] Jacobs (2022). Teddington DRA: Ham Lands Preliminary Ecological Appraisal. Report for Thames Water Utilities Ltd, 1 – 38. B22849BM/REP/PEA/004.

Designated site name:	**Thames Basin Heaths (UK9012141)**	
Designation type: (SAC, SPA, Ramsar):	**SPA**	
Qualifying features:	302 *Sylvia undata*; Dartford warbler (breeding) 224 *Caprimulgus europaeus*; Nightjar (breeding) 246 *Lullula arborea*; Woodlark (breeding)	**Water Dependency** Species identified as water dependent: • 302 *Sylvia undata*; Dartford warbler • 224 *Caprimulgus europaeus*; Nightjar • 246 *Lullula arborea*; Woodlark
Current conservation status:	**302 *Sylvia undata*; Dartford warbler** (status: short term – decreasing, long term – increasing; type: breeding; size: minimum – 445, maximum 445; unit: pairs; data quality: good; population: 15 - 100%; isolation: population non-isolated within extended distribution range; and global grade: excellent value). **224 *Caprimulgus europaeus*; Nightjar** (status: short term – increasing, long term – increasing; type: breeding; size: minimum – 264, maximum 264; unit: pairs; data quality: good; population: 2 – 15%; isolation: population non-isolated within extended distribution range; and global grade: good value). **246 *Lullula arborea*; Woodlark** (status: short term – increasing, long term – increasing; type: breeding; size: minimum – 149, maximum 149; unit: pairs; data quality: good; population: 2 – 15%; isolation: population non-isolated within extended distribution range; and global grade: good value).	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and • The distribution of the qualifying features within the site.	
SSSI Condition assessment:	Ash to Brookwood Heaths SSSI: 61.37% Favourable and 31.65% Unfavourable - Recovering; Bourley and Long Valley SSSI: 99.14% Unfavourable – Recovering and 0.86% Favourable; Bramshill SSSI: 99.94% Unfavourable – Recovering and 0.06% Unfavourable – No change; Broadmoor to Bagshot Woods and Heaths SSSI: 75.65% Favourable, 23.83% Unfavourable – Recovering and 0.55% Unfavourable – No change; Castle Bottom to Yateley and Hawley Commons SSSI: 69.69% Unfavourable – Recovering, 26.67% Favourable, 2.82% Unfavourable – Declining and 0.81% Unfavourable – No change; Chobham Common SSSI: 56.95% Unfavourable – Recovering and 43.05% Favourable; Colony Bog and Bagshot Heath SSSI: 94.94% Favourable, 4.39% Unfavourable – Recovering and 0.67% Unfavourable - Declining; Eelmoor Marsh SSSI: 100% Favourable; Hazeley Heath SSSI: 96.11% Unfavourable – Recovering and 3.89% Unfavourable - Declining; Horsell Common SSSI: 78.47% Unfavourable – Recovering and 21.53% Favourable; Ockham and Wisley Commons SSSI: 54.01% Favourable and 45.99% Unfavourable - Recovering; Sandhurst to Owlsmoor Bogs and Heaths SSSI: 100% Unfavourable - Recovering; and Whitmoor Common SSSI: 76.43% Favourable, 22.24% Unfavourable – Recovering and 1.33% Unfavourable – No change.	
Site Improvement Plan:	1. Public access/disturbance – Pressure/Threat – 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Agree and implement an over-arching access management strategy. 2. Undergrazing – Pressure – 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Agree and implement an over-arching habitat management strategy. 3. Forestry and woodland management – Pressure - 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Review and agree forestry plans/policies to ensure compatibility with objectives. 4. Inappropriate scrub control – Pressure - 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Agree habitat management strategies for all sites. 5. Wildlife/ arson – Pressure - 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Agree and implement fire risk reduction strategies at all sites. 6. Air pollution: impact of atmospheric nitrogen deposition – Pressure/ Threat - 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Agree and implement Nitrogen management/mitigation strategies at all sites. 7. Feature location/ extent/ condition unknown – Threat - 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Develop and implement improved bird monitoring strategy. 8. Military – Threat - 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Agree and implement integrated management plans for military sites. 9. Habitat fragmentation – Pressure - 224 Nightjar, 246 Woodlark and 302 Dartford warbler – Commission study to identify habitat management priorities to reduce fragmentation.	
Potential Effects		
London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone? / If no LSEs alone: residual low-level effect requiring in-combination assessment?
Mogden water recycling scheme	This London Effluent Reuse scheme is approximately 7.3 km north-east of the Thames Basin Heaths SPA. No land take within the SPA is proposed and they are not hydrologically connected. The only Site Improvement Plan pressure/ threat of potential relevance is (6) air pollution. Due to the distance between the London Effluent Reuse scheme and designated site, no impacts from air pollution, noise, light, vibration or visual disturbance are anticipated. Therefore, there are no LSEs on the qualifying features of this designated site.	**No** / **No**

Designated site name:	**Thursley, Ash, Pirbright and Chobham (UK0012793)**	
Designation type: (SAC, SPA, Ramsar):	**SAC**	
Qualifying features:	4010 Northern Atlantic wet heaths with *Erica tetralix* 4030 European dry heaths 7150 Depressions on peat substrates of the Rhynchosporion	**Water Dependency** Species identified as water dependent: • 4010 Northern Atlantic wet heaths with *Erica tetralix.* • 4030 European dry heaths. • 7150 Depressions on peat substrates of the Rhynchosporion.
Current conservation status:	**4010 Northern Atlantic wet heaths with *Erica tetralix*: Unfavourable – bad** (range: favourable, area: unfavourable - inadequate, structure and function: unfavourable - bad, future prospects: unfavourable – bad and overall trend: deteriorating). **4030 European dry heaths: Unfavourable – bad (**range: favourable, area: favourable, structure and function: unfavourable - bad, future prospects: unfavourable – bad and overall trend: improving). **7150 Depressions on peat substrates of the Rhynchosporion: Unfavourable – bad** (range: favourable, area: unknown, structure and function: unfavourable - bad, future prospects: unfavourable – bad and overall trend: stable).	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats • The structure and function (including typical species) of qualifying natural habitats, and • The supporting processes on which qualifying natural habitats rely.	
SSSI Condition assessment:	Ash to Brookwood Heaths SSSI: 61.37% Favourable and 31.65% Unfavourable - Recovering; Chobham Common SSSI: 56.95% Unfavourable – Recovering and 43.05% Favourable; Colony Bog and Bagshot Heath SSSI: 94.94% Favourable, 4.39% Unfavourable – Recovering and 0.67% Unfavourable - Declining; and Thursley, Hankley and Frensham Commons SSSI: 82.10% Favourable and 17.90% Unfavourable – Recovering.	
Site Improvement Plan:	1. Undergrazing – Pressure – 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 7150 Depressions on peat substrates of the Rhynchosporion – Agree and implement an over-arching habitat management strategy. 2. Forestry and woodland management – Pressure - 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths – Review and agree forestry plans/policies to ensure compatibility with objectives. 3. Hydrological changes – Threat - 4010 Northern Atlantic wet heaths with *Erica tetralixa* and 7150 Depressions on peat substrates of the Rhynchosporion – Hydrological investigations. 4. Inappropriate scrub control – Pressure - 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths – Agree habitat management strategies for all sites. 5. Invasive species – Pressure/Threat - 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths – Agree and implement invasive control strategies at all relevant sites. 6. Wildlife/ arson – Pressure - 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 7150 Depressions on peat substrates of the Rhynchosporion – Agree and implement fire risk reduction strategies at all sites. 7. Air pollution: impact of atmospheric nitrogen deposition – Pressure/ Threat - 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 7150 Depressions on peat substrates of the Rhynchosporion – Agree and implement Nitrogen management/mitigation strategies at all sites. 8. Military – Threat - 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 7150 Depressions on peat substrates of the Rhynchosporion – Agree and implement integrated management plans for military sites. 9. Habitat fragmentation – Pressure -4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 7150 Depressions on peat substrates of the Rhynchosporion – Commission study to identify habitat management priorities to reduce fragmentation.	
Potential Effects		
London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone? / If no LSEs alone: residual low-level effect requiring in-combination assessment?
Mogden water recycling scheme	This London Effluent Reuse scheme is approximately 9.9 km north-east of the Thursley, Ash, Pirbright and Chobham SAC. The Site Improvement Plan pressures and threats of potential relevance are (3) hydrological changes, (5) invasive species and (7) air pollution. As no land take is required within the SAC and the London Effluent Reuse scheme and designated site are not hydrologically connected, both hydrological changes and invasive species can be removed from further consideration. In addition, due to the distance between the proposed works and designated site, no impact pathways from air pollution are expected. Therefore, no LSEs on the qualifying features of this designated site are anticipated.	**No** / **No**

Designated site name:	**Epping Forest (UK0012720)**	
Designation type: (SAC, SPA, Ramsar):	**SAC**	
Qualifying features:	9120 Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrub layer (*Quercion robori-petraeae* or *Ilici-Fagenion*). 4010 Northern Atlantic wet heaths with *Erica tetralix* 4030 European dry heaths 1083 Stag beetle *Lucanus cervus*	**Water Dependency** Species identified as water dependent: • 4030 European dry heaths; and • 4010 Northern Atlantic wet heaths with *Erica tetralix*
Current conservation status:	**9120 Atlantic acidophilous beech forests** with *Ilex* and sometimes also *Taxus* in the shrub layer (*Quercion robori-petraeae* or *Ilici-Fagenion*): **Unfavourable - bad** (range: favourable, area: unfavourable - inadequate, structure and function: unfavourable - bad, future prospects: unfavourable – bad and overall trend: stable). **4010 Northern Atlantic wet heaths with *Erica tetralix*: Unfavourable – bad** (range: favourable, area: unfavourable - inadequate, structure and function: unfavourable - bad, future prospects: unfavourable – bad and overall trend: deteriorating). **4030 European dry heaths: Unfavourable – bad (**range: favourable, area: favourable, structure and function: unfavourable - bad, future prospects: unfavourable – bad and overall trend: improving). **1083 Stag beetle: Favourable (**range: favourable, population: favourable, habitat for species: favourable, future prospects: favourable and overall trend: stable).	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats • The structure and function of the habitats of qualifying species • The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely • The populations of qualifying species, and, • The distribution of qualifying species within the site.	
SSSI Condition assessment:	Epping Forest SSSI: 35.48% Favourable, 48.17% Unfavourable – Recovering, 14.53% Unfavourable – No change and 1.83% Unfavourable – Declining.	
Site Improvement Plan:	1. Air pollution: impact of atmospheric nitrogen deposition – Pressure – 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 9120 Atlantic acidophilous beech forests – Establish a Site Nitrogen Action Plan. 2. Undergrazing – Pressure - 4010 Northern Atlantic wet heaths with *Erica tetralix* and 4030 European dry heaths – Partnership agreement to ensure sufficient resources for appropriate grazing. 3. Public access/ disturbance – Pressure - 4010 Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 9120 Atlantic acidophilous beech forests – Identify key areas and agree a plan to maintain SAC features. 4. Changes in species distribution – Threat – 9120 Atlantic acidophilous beech forests - Investigate tree health and recruitment in key areas to establish a baseline for monitoring. Agree actions and implement a management plan. 5. Inappropriate water levels – Threat - Northern Atlantic wet heaths with *Erica tetralix* – Hydrological monitoring, and a possible water level management plan. 6. Water pollution – Threat - Northern Atlantic wet heaths with *Erica tetralix* – Investigate water quality run-off from roads, agree actions and implement a management plan. 7. Invasive species – Threat/pressure – Atlantic acidophilous beech forests and Northern Atlantic wet heaths with *Erica tetralix* – Investigate impact and review the current monitoring programme, agree actions and implement a management plan. 8. Disease – Threat - Atlantic acidophilous beech forests - Investigate impact, agree actions and implement a management plan.	

Potential Effects

London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs)?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Beckton water recycling scheme	This London Effluent Reuse scheme is located approximately 1.5 km south-east of the Epping Forest SAC. The Site Improvement Plan threats and pressures of potential relevance to this London Effluent Reuse scheme include (1) air pollution, (5) inappropriate water levels, (6) water pollution and (7) invasive species. No land take within the boundaries of the SAC is currently proposed and therefore, no direct impacts on qualifying habitats has been identified. However, due to the proximity of Shaft/ Compound 3 to Epping Forest SSSI (approximately 30 m), impact pathways to stag beetle if present have been identified. These include direct mortality if present within the footprint of Shaft/ Compound 3 and disturbance via noise and dust during construction. Increased emissions during construction could also impact on the health of supporting habitat. To determine the likely presence of stag beetle during the proposed works, a radio telemetric stag beetle monitoring study was reviewed. The study concluded that the colonisation of new stag beetle nest sites depended on the dispersal ability of females, as male dispersal was directed by reproductive females. The maximum dispersal distance recorded for female stag beetles was 727 m[105]. Adopting a precautionary approach, a 1 km buffer of Epping Forest SAC was used to identify potential functionally linked habitat. Ancient woodland is present between Epping Forest SAC and Epping Forest SSSI unit 138, which could provide a commuting pathway between the two designated sites, that are 1.3 km apart from the closest point. One record of stag beetle within 0.55 km of Shaft/ Compound 3 was received by Essex Field Club, which was recorded in 2012 with urban housing. However, unit 138 of the Epping Forest SSSI is lowland acid grassland/ heathland habitat and not optimal for stag beetle that typically reside in deciduous woodland with decaying wood present. Stag beetles are also not mentioned in the SSSI citation. The proposed footprint for Shaft/ Compound 3 also consists of modified grassland and developed land, sealed surface (UKHabs survey conducted by Jacobs[106]). Based on the habitats within and adjacent to the proposed works and limited records of stag beetle within 1 km of Shaft/ Compound 3, no likely significant effects on stag beetles have been identified during construction due to low likelihood of presence.	**No**	**No**

[105] Rink, M. and Sinsch, U. (2007) Radio-telemetric monitoring of dispersing stag beetles: implications for conservation. *Journal of Zoology*, 272 (3), pp. 235-243

[106] Jacobs (2022). Beckton Tunnel Conveyance Route: Preliminary Ecological Appraisal. Report for Thames Water Utilities, 1 – 85. B22849BM/REP/PEA/002.

Designated site name:	Epping Forest (UK0012720)		
	The Beckton effluent reuse scheme is hydrologically connected to Epping Forest via the River Ching; a tributary of the River Lee Diversion. Although hydrologically connected, as the SAC is located upstream of the confluence between the Ching River and River Lee Diversion, no impact pathways due to changes in water levels and exposure to water pollution and aquatic invasive species have been identified for the Epping Forest SAC and its qualifying features. Therefore, no LSEs are anticipated.		

Designated site name:	**Lee Valley (UK9012111)**	
Designation type: (SAC, SPA, Ramsar):	**SPA**	
Qualifying features:	021 *Botaurus stellaris*; Great bittern (wintering) 051 *Anas strepera*; Gadwall (wintering) 056 *Anas clypeata*; Northern shoveler (wintering)	**Water Dependency** Species identified as water dependent: • 021 *Botaurus stellaris*; Great bittern • 051 *Anas strepera*; Gadwall • 056 *Anas clypeata*; Northern shoveler
Current conservation status:	**021 *Botaurus stellaris*; Great bittern** (status: short term – increasing, long term – increasing; type: non-breeding, size: minimum – 6, maximum 6, represented 6% of the British population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 2 – 15%, isolation: population not-isolated within extended distribution range) **051 *Anas strepera*; Gadwall** (status: short term – increasing, long term – increasing; type: non-breeding, size: minimum – 456, maximum 456, represented 1.5% of the North West European population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: <2%, isolation: population not-isolated within extended distribution range) **056 *Anas clypeata;* Northern shoveler** (status: short term – increasing, long term – increasing; type: non-breeding, size: minimum –406, maximum 406, represented 1% of the North West/Central European population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: <2%, isolation: population not-isolated within extended distribution range)	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and, • The distribution of the qualifying features within the site.	
SSSI Condition assessment:	Amwell Quarry SSSI: 100% Favourable; Rye Meads SSSI: Favourable 39.95% and Unfavourable – Recovering 60.05%; Turnford and Cheshunt SSSI: 100% Favourable; and Walthamstow Reservoirs SSSI: 100% Unfavourable – Recovering.	
Site Improvement Plan:	1. Water pollution – Threat – 021 Great bittern, 051 Gadwall and 056 Northern shoveler – Investigate and agree appropriate water quality. 2. Hydrological changes – Threat - 021 Great bittern, 051 Gadwall and 056 Northern shoveler – Investigate and agree appropriate water levels. 3. Public access/ disturbance – Threat - 021 Great bittern, 051 Gadwall and 056 Northern shoveler – Investigate recreational pressure priority areas and agree management measures. 4. Inappropriate scrub control – Threat - 021 Great bittern, 051 Gadwall and 056 Northern shoveler – Manage scrub to required levels to maintain/ restore habitat. 5. Fisheries: fish stocking – Threat - 021 Great bittern, 051 Gadwall and 056 Northern shoveler – Investigate and agree appropriate fish stocking. 6. Inappropriate cutting/ mowing – 021 Great bittern – Manage reed beds for Great bittern. 7. Air pollution: risk of atmospheric nitrogen deposition – Threat – 021 Great bittern – Investigate the potential impacts of air pollution.	

Potential Effects			
London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Beckton water recycling scheme tunnel	The footprint of this London Effluent Reuse scheme crosses over the boundaries of the Lee Valley SPA. The Site Improvement Plan threats and pressures of potential relevance to this London Effluent Reuse scheme include (1) water pollution, (2) hydrological changes, (3) public access/ disturbance and (7) air pollution: risk of atmospheric nitrogen deposition. The tunnel required for the scheme will be created using a Tunnel Boring Machine (TBM). Drive shafts need to have a 12.5 m internal diameter and 5,000 m² area for the construction site and reception shafts need to have a 10.5 m internal diameter and 2,500 m² area for construction. The proposed tunnel route to the discharge location in the River Lee Diversion intersects with several waterbodies including: the south-western extent of Walthamstow Reservoirs, the western edge of Reservoir No.1, Coppermill stream and the River Lee Diversion. If construction works are conducted during the wintering season (September – March) for great bittern, gadwall and northern shoveler, they will be exposed to increased noise, light and vibration disturbance. Increased human activity could cause disturbance while roosting, foraging, feeding and resting/ loafing, a change in species distribution and decline in population abundance at the designated site. Construction works also increase the likelihood of water pollution incidents from construction vehicles and increase localised air pollution, if not managed appropriately following best practice guidelines. Installation of the pipeline could also impede natural groundwater supply, impacting on water levels of waterbodies associated with the SPA. Outside of the boundaries of the SPA and Ramsar site, approximately 1.54 km of the proposed tunnel runs through Wanstead Flats; wood pasture and parkland Biodiversity Action Plan (BAP) priority habitat. Two shaft sites are also located in the Wanstead Flats which will require up to 10,000 m² construction area. Wanstead Flats is also noted as a 'notable stop-off for migrating birds' particularly in autumn[107]. As tunnels will be 25 m below surface level and created using a TBM rather than open cut construction methods, no habitat removal is anticipated as a result of the tunnel. However, at the proposed shaft locations, loss of supporting habitat is anticipated. During operation, up to 300 Ml/d of recycled water will be discharged into the River Lee diversion for abstraction into one of Thames Water's reservoirs. Due to the mixing zone within the River Lee prior to abstraction, no changes in water quality within the reservoirs are anticipated. As the total recycled water will be abstracted at Thames Water Chingford South intake and Thames Water Chingford supply channel intake upstream of the SPA, no impacts on water depth in the reservoirs are anticipated. However, LSEs as a result of habitat loss, disturbance and air quality issues during construction cannot be ruled out at this stage.	**Yes**	**N/A**

[107] Martin, F and Sinclair. G. (2020). Wanstead Flats, Individual Site Plan. City of London Democracy. Version 4, 1 – 45.

Designated site name:	**Lee Valley (UK1037)**	
Designation type: (SAC, SPA, Ramsar):	**Ramsar**	
Qualifying features:	**Ramsar Criterion 2** The site supports the following nationally important and rare/vulnerable species: *Myriophyllum verticillatum*; whorled water-milfoil *Micronecta minutissima*; waterboatman **Ramsar Criterion 6** Species/ populations occurring at levels of international importance. Species with peak counts in spring/autumn: *Anas strepera*; Gadwall (wintering) - 445 individuals, representing an average of 2.6% of the British population (5 year peak mean 1998/9 – 2002/3). Species with peak counts in winter: *Anas clypeata;* Northern shoveler (wintering) - 287 individuals, representing an average of 1.9% of the British population (5 year peak mean 1998/9 – 2002/3).	**Water Dependency** Species identified as water dependent: • *Myriophyllum verticillatum*; whorled water-milfoil • *Micronecta minutissima*; waterboatman • *Anas strepera*; Gadwall • *Anas clypeata;* Northern shoveler
Current conservation status:	N/A	
Conservation objectives:	Information not currently available.	
SSSI Condition assessment:	Amwell Quarry SSSI: 100% Favourable; Rye Meads SSSI: Favourable 39.95% and Unfavourable – Recovering 60.05%; Turnford and Cheshunt SSSI: 100% Favourable; and Walthamstow Reservoirs SSSI: 100% Unfavourable – Recovering.	
Site Improvement Plan:	Information not currently available.	

Potential Effects

London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Beckton water recycling scheme tunnel	The footprint of this London Effluent Reuse scheme crosses over the boundaries of the Lee Valley Ramsar site. Potential impact pathways include water pollution, hydrological changes, disturbance, air pollution and introduction of invasive and non-native species (INNS). The tunnel required for the scheme will be created using a Tunnel Boring Machine (TBM). Drive shafts need to have a 12.5 m internal diameter and 5,000 m² area for the construction site and reception shafts need to have a 10.5 m internal diameter and 2,500 m² area for construction. The proposed tunnel route to the discharge location in the River Lee Diversion intersects with several waterbodies including: the south-western extent of Walthamstow Reservoirs, the western edge of Reservoir No.1, Coppermill stream and the River Lee Diversion. If construction works are conducted during the wintering season (September – March) for great bittern, gadwall and northern shoveler, they will be exposed to increased noise, light and vibration disturbance. Increased human activity could cause disturbance while roosting, foraging, feeding and resting/ loafing, a change in species distribution and decline in population abundance at the designated site. Construction works also increase the likelihood of water pollution incidents, introduction/ spread of INNS from construction vehicles and increase localised air pollution, if not management appropriately following best practice guidelines. Installation of the pipeline could also impede natural groundwater supply, impacting on water levels of waterbodies associated with the SPA. Outside of the boundaries of the SPA and Ramsar site, approximately 1.54 km of the proposed tunnel runs through Wanstead Flats; wood pasture and parkland Biodiversity Action Plan (BAP) priority habitat. Two shaft sites are also located in the Wanstead Flats which will require up to 10,000 m² construction area. Wanstead Flats is also noted as a 'notable stop-off for migrating birds' particularly in autumn[108]. As tunnels will be 25 m below surface level and created using a TBM rather than open cut construction methods, no habitat removal is anticipated as a result of the tunnel. However, at the proposed shaft locations, loss of supporting habitat is anticipated. During operation, up to 300 Ml/d of recycled water will be discharged into the River Lee diversion for abstraction into one of Thames Water's reservoirs. Due to the mixing zone within the River Lee prior to abstraction, no changes in water quality within the reservoirs are anticipated. As the total recycled water will be abstracted at Thames Water Chingford South intake and Thames Water Chingford supply channel intake upstream of the SPA, no impacts on water depth in the reservoirs are anticipated. However, LSEs as a result of habitat loss, disturbance and air quality issues during construction cannot be ruled out at this stage.	**Yes**	**N/A**

[108] Martin, F and Sinclair. G. (2020). Wanstead Flats, Individual Site Plan. City of London Democracy. Version 4, 1 – 45.

Designated site name:	**Wimbledon Common (UK0030301)**	
Designation type: (SAC, SPA, Ramsar):	**SAC**	
Qualifying features:	4010 Northern Atlantic wet heaths with *Erica tetralix* 4030 European dry heaths 1083 Stag beetle *Lucanus cervus*	**Water Dependency** Species identified as water dependent: • 4010 Northern Atlantic wet heaths with *Erica tetralix* • 4030 European dry heaths
Current conservation status:	**4010 Northern Atlantic wet heaths with *Erica tetralix*: Unfavourable – recovering** (range: favourable, area: unfavourable – inadequate, structure and function: unfavourable – bad, future prospects: unfavourable – bad and overall trend: deteriorating). **4030 European dry heaths: Unfavourable – recovering (**range: favourable, area: favourable, structure and function: unfavourable – bad, future prospects: unfavourable – bad and overall trend: improving). **1083 Stag beetle: Favourable (**range: favourable, population: favourable, habitat for species: favourable, future prospects: favourable and overall trend: stable).	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats • The structure and function of the habitats of qualifying species • The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely • The populations of qualifying species, and, • The distribution of qualifying species within the site.	
SSSI Condition assessment:	Wimbledon Common SSSI: 94.99% Unfavourable – recovering; and 5.01% Unfavourable – no change.	
Site Improvement Plan:	1. Public access/ disturbance – Pressure – Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 1083 Stag beetle – Implement measures to reduce visitor impact. 2. Habitat fragmentation – Threat – 1083 Stag beetle – Species recovery project. 3. Invasive species – Threat – Northern Atlantic wet heaths with *Erica tetralix,* 4030 European dry heaths and 1083 Stag beetle – Develop an invasive species response plan. 4. Air pollution: impact of atmospheric nitrogen deposition – Pressure – Northern Atlantic wet heaths with *Erica tetralix* and 4030 European dry heaths – Establish a Site Nitrogen Action Plan.	

Potential Effects

London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Mogden water recycling scheme	The option is approximately 3.9 km north-west of Wimbledon Common SAC at its closest point. The Site Improvement Plan pressure of potential relevance that could be affected by this option is (4) air pollution during construction. Due to the distance between the pipeline and the SAC, no significant air pollution impacts are anticipated during construction. The designated site is hydrologically connected to the River Thames via Beverley Brook but as this watercourse is upstream of the River Thames, no impact pathways have been identified during operation. Therefore, no LSEs are anticipated.	**No**	**No**
Teddington DRA scheme	The option is approximately 2.6 km west of Wimbledon Common SAC at its closest point. The Site Improvement Plan pressure of potential relevance that could be affected by this option is (4) air pollution during construction. Due to the distance between the pipeline and the SAC, no significant air pollution impacts are anticipated during construction. The designated site is hydrologically connected to the River Thames via Beverley Brook but as this watercourse is upstream of the River Thames, no impact pathways have been identified during operation. Therefore, no LSEs are anticipated.	**No**	**No**

Designated site name:	**Thames Estuary and Marshes (UK9012021)**	
Designation type: (SAC, SPA, Ramsar):	**SPA**	
Qualifying features:	132 *Recurvirostra avosetta;* Pied avocet (wintering) 616 *Limosa islandica;* Black-tailed godwit (wintering) 672 *Calidris alpina*; Dunlin (wintering) 141 *Pluvialis squatarola*; Grey plover (wintering) 082 *Circus cyaneus*; Hen harrier (wintering) 143 *Calidris canutus*; Red knot (wintering) 162 *Tringa totanus*; Common redshank (wintering) 137 *Charadrius hiaticula*; Common ringed plover (passage) WATR Waterfowl assemblage	**Water Dependency** Species identified as water dependent: • 132 *Recurvirostra avosetta;* Pied avocet • 616 *Limosa islandica;* Black-tailed godwit • 672 *Calidris alpina*; Dunlin • 141 *Pluvialis squatarola*; Grey plover • 082 *Circus cyaneus*; Hen harrier • 143 *Calidris canutus*; Red knot • 162 *Tringa totanus*; Common redshank • 137 *Charadrius hiaticula*; Common ringed plover • WATR Waterfowl assemblage
Current conservation status:	**132 *Recurvirostra avosetta;* Pied avocet** (status: short term – increasing, long term – increasing; type: non-breeding, size: minimum – 283, maximum 283, represented 28.3% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 15 – 100%, isolation: population not-isolated within extended distribution range) **616 *Limosa limosa islandica;* Black-tailed godwit** (status: short term – increasing, long term – increasing; type: non-breeding, size: minimum – 1699, maximum 1699, represented 2.4% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 2 – 15%, isolation: population not-isolated within extended distribution range) **672 *Calidris alpina*; Dunlin** (status: short term – stable, long term – decreasing; type: non-breeding, size: minimum –29,646, maximum 29,646, represented 2.1% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 2 – 15%, isolation: population not-isolated within extended distribution range) **141 *Pluvialis squatarola*; Grey plover** (status: short term – stable, long term – increasing; type: non-breeding, size: minimum –2593, maximum 2593, represented 1.7% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: <2%, isolation: population not-isolated within extended distribution range) **082 *Circus cyaneus*; Hen harrier** (status: short term – unknown, long term – unknown; type: non-breeding, size: minimum – 7, maximum 7, represented 1% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: <2%, isolation: population not-isolated within extended distribution range) **143 *Calidris canutus*; Red knot** (status: short term – stable, long term – increasing; type: non-breeding, size: minimum – 4848, maximum 4848, represented 1.4% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: <2%, isolation: population not-isolated within extended distribution range) **162 *Tringa totanus*; Common redshank** (status: short term – decreasing, long term – stable; type: non-breeding, size: minimum – 3251, maximum 3251, represented 2.2% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 2 – 15%, isolation: population not-isolated within extended distribution range) **137 *Charadrius hiaticula*; Common ringed plover** (status: short term – decreasing, long term – decreasing; type: passage, size: minimum – 1324, maximum 1324, represented 2.6% of the population (5 year peak mean 1993/94 – 1997/98 based on WeBS data supplied by BTO); unit: individual, data quality: good, population: 2 – 15%, isolation: population not-isolated within extended distribution range) **WATR Waterfowl assemblage** (Overwinter the area regularly supports size: minimum – 75019, maximum 75019 (5 year peak mean 1991/92 – 1995/96), international conventions)	
Conservation objectives:	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features • The structure and function of the habitats of the qualifying features • The supporting processes on which the habitats of the qualifying features rely • The population of each of the qualifying features, and, • The distribution of the qualifying features within the site.	
SSSI Condition assessment:	Mucking Flats and Marshes SSSI: 94.13% Favourable, 5.87% Unfavourable – recovering; and South Thames Estuary and Marshes SSSI: 95.28% Favourable, 2.35% Unfavourable – recovering, 1.79% Unfavourable – declining and 0.59% Unfavourable – no change.	
Site Improvement Plan:	1. Coastal squeeze – Pressure – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover and WATR Waterfowl assemblage – Implement the South East Habitat Creation Programme. 2. Public access/ disturbance – Pressure/Threat – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover and WATR Waterfowl assemblage – Investigate sources of disturbance within the SPAs to inform management. 3. Invasive species – Threat – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover and WATR Waterfowl assemblage – Establish the baseline of Carpet sea squirt and Pacific Oyster distribution. 4. Changes in species distributions – Pressure/Threat – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover and WATR Waterfowl assemblage – Investigation to identify cause of the decline in SPA birds. 5. Fisheries: Commercial marine and estuarine – Pressure/Threat – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover and WATR Waterfowl assemblage – Investigate fishing activity and mechanisms for regulating it. 6. Invasive species – Threat – WATR Waterbird assemblages – Investigate the impact of freshwater invasive species on SPA birds. 7. Invasive species – Threat – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover – Investigate the impact of *Spartina anglica* on native saltmarsh and birds. 8. Vehicles: illicit – Pressure – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover and WATR Waterfowl assemblage – Collate and report incidences of illicit vehicle use. 9. Fisheries: Commercial marine and estuarine – Threat – 132 Avocet, 616 Black-tailed godwit, 672 Dunlin, 141 Grey plover, 082 Hen harrier, 143 Red knot, 162 Common redshank, 137 Ringed plover and WATR Waterfowl assemblage – Introduce appropriate management as required and ensure compliance with bye-laws. 10. Air pollution: risk of atmospheric nitrogen deposition – Threat – 082 Hen harrier – Control, reduce and ameliorate atmospheric nitrogen impacts.	
Potential Effects		

Designated site name:	**Thames Estuary and Marshes (UK9012021)**		
London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Beckton water recycling scheme tunnel	This option is approximately 24.3 km north-west of the Thames Estuary and Marshes SPA at its closest point and 27.2 km via hydrological connectivity from the point of construction works, adjacent to the River Roding. The Site Improvement Plan threats and pressures of potential relevance to this option component is (4) changes in species distribution and (10) air pollution. As part of Beckton water recycling scheme construction works are proposed at the current Beckton STW facility, which is within close proximity of the River Roding that is hydrologically connected to the SPA via the River Thames. In addition, where the final effluent will be abstracted from Beckton STWs outfall, near the Barking Creek Barrier at the confluence of the River Roding, wet wells will be installed onto the side of the final effluent conduits to capture the effluent and pump it via screens to the new AWRP. In the absence of mitigation, there is potential for pollution incidents and sediment discharge during construction works entering the River Roding and River Thames, negatively impacting on supporting saltmarsh and intertidal mudflat habitat. No air pollution impacts are anticipated due to the distance between the proposed works and the designated site. As saltmarsh and mudflat habitat is also present along the River Roding, there is potential for visual, noise and vibration disturbance on functionally linked, supporting habitat of the SPA if construction works are conducted during the wintering season (September – March). No operational impacts on the SPA have been identified. Therefore, in the absence of mitigation, LSEs on qualifying species of the SPA during construction cannot be ruled out at this stage.	**Yes**	**N/A**

Designated site name:	**Thames Estuary and Marshes (UK11069)**	
Designation type: (SAC, SPA, Ramsar):	**Ramsar**	
Qualifying features:	**Ramsar criterion 2** The site supports one endangered plant species and at least 14 nationally scarce plants of wetland habitats. The site also supports more than 20 British Red Data Book invertebrates. **Ramsar criterion 5** Assemblages of international importance. Species with peak counts in winter: 45118 waterfowl (5 year peak mean 1998/99-2002/2003). **Ramsar criterion 6** Qualifying species/populations Species with peak counts in spring/autumn: *Charadrius hiaticula*; Common ringed plover (passage) - 595 individuals, representing an average of 1.8% of the GB population (5 year peak mean 1998/9-2002/3). *Limosa limosa islandica;* Black-tailed godwit (wintering) - 1640 individuals, representing an average of 4.6% of the population (5 year peak mean 1998/9-2002/3)**.** Species with peak counts in winter: *Pluvialis squatarola*; Grey plover (wintering) - 1643 individuals, representing an average of 3.1% of the GB population (5 year peak mean 1998/9-2002/3). *Calidris canutus*; Red knot (wintering) - 7279 individuals, representing an average of 1.6% of the population (5 year peak mean 1998/9-2002/3). *Calidris alpina alpina*; Dunlin (wintering)- 15171 individuals, representing an average of 1.1% of the population (5 year peak mean 1998/9-2002/3). *Tringa totanus*; Common redshank (wintering) - 1178 individuals, representing an average of 1% of the GB population (5 year peak mean 1998/9-2002/3) .	**Water Dependency** Species identified as water dependent: • Wetland plant assemblage • Wetland invertebrate assemblage • *Limosa limosa islandica;* Black-tailed godwit • *Calidris alpina alpina*; Dunlin • *Pluvialis squatarola*; Grey plover • *Calidris canutus*; Red knot • *Tringa totanus*; Common redshank • *Charadrius hiaticula*; Common ringed plover
Current conservation status:	**N/A**	
Conservation objectives:	Information not currently available.	
SSSI Condition assessment:	Mucking Flats and Marshes SSSI: 94.13% Favourable, 5.87% Unfavourable – recovering; and South Thames Estuary and Marshes SSSI: 95.28% Favourable, 2.35% Unfavourable – recovering, 1.79% Unfavourable – declining and 0.59% Unfavourable – no change.	
Site Improvement Plan:	Information not currently available.	

Potential Effects

London Effluent Reuse scheme:	Screening assessment	Risk of Likely Significant Effects (LSEs) alone?	If no LSEs alone: residual low-level effect requiring in-combination assessment?
Beckton water recycling scheme tunnel	This option is approximately 23.2 km north-west of the Thames Estuary and Marshes Ramsar site at its closest point and 27.2 km via hydrological connectivity from the point of construction works, adjacent to the River Roding. As part of Beckton water recycling scheme construction works are proposed at the current Beckton STW facility, which is within close proximity of the River Roding that is hydrologically connected to the Ramsar site via the River Thames. In addition, where the final effluent will be abstracted from Beckton STWs outfall, near the Barking Creek Barrier at the confluence of the River Roding, wet wells will be installed onto the side of the final effluent conduits to capture the effluent and pump it via screens to the new AWRP. In the absence of mitigation, there is potential for pollution incidents and sediment discharge during construction works entering the River Roding and River Thames, negatively impacting on supporting saltmarsh and intertidal mudflat habitat. In the absence of mitigation, there is potential for pollution incidents and sediment discharge during construction works entering the River Roding and negatively impacting saltmarsh habitat of the qualifying bird and invertebrate species. No air pollution impacts are anticipated due to the distance between the proposed works and the designated site. As saltmarsh and mudflat habitat is also present along the River Roding, there is potential for visual, noise and vibration disturbance on functionally linked, supporting habitat of the Ramsar site if construction works are conducted during the wintering season (September – March). No operational impacts on the Ramsar site have been identified. Therefore, in the absence of mitigation, LSEs on qualifying species of the Ramsar site cannot be ruled out at this stage.	**Yes**	**N/A**

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