

Teddington Direct River Abstraction

Preliminary Environmental Information Report Chapter 17 – Carbon

Volume: 1

Date: June 2025

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17. Carbon

17.1 Introduction

- 17.1.1 This chapter of the Preliminary Environmental Information (PEI) Report provides preliminary environmental information relating to the potential changes in greenhouse gas (GHG) emissions associated with the Teddington Direct River Abstraction Project (hereafter referred to as 'the Project'), to allow stakeholders and the local community to understand and develop an informed view of the likely significant effects of the Project at this stage of the Project's programme. This should be read in conjunction with the description of the Project as presented in Chapter 2: Project Description.
- 17.1.2 Where it is practical and proportionate to do so (e.g. where industry-recognised emission factors are available), this chapter has considered emissions of the seven GHGs that directly contribute to climate change, namely:
 - a. Carbon dioxide (CO₂)
 - b. Methane (CH₄)
 - c. Nitrous oxide (N₂O)
 - d. Hydrofluorocarbons (HFCs)
 - e. Perfluorocarbons (PFCs)
 - f. Nitrogen trifluoride (NF₃)
 - g. Sulphur hexafluoride (SF₆).
- 17.1.3 As each of these GHGs have a different Global Warming Potential (GWP), emissions of GHGs have been expressed throughout this chapter as emissions of carbon dioxide equivalent (CO₂e) i.e. the equivalent amount of CO₂ with the same GWP. Hereafter therefore, and to be consistent with the terminology used in relevant national, regional and local policy, emissions of GHGs are referred to as 'carbon' emissions.
- 17.1.4 In line with paragraph 4.4.12 of the National Policy Statement (NPS) for Water Resources Infrastructure (Department for Environment, Food & Rural Affairs (Defra), 2023), this chapter provides a preliminary assessment of the potential impact of the Project on climate by estimating potential changes in carbon emissions.
- 17.1.5 The assessment set out in this chapter considers potential changes in carbon emissions as a result of both the construction and operation of the Project.
- 17.1.6 This chapter is supported by Volume 3 PEI Report Appendix 17.1: Carbon Emissions Estimation Approach.

17.2 Legislation, policy and guidance

Legislation

- 17.2.1 The Climate Change Act 2008 commits the United Kingdom (UK) to reducing carbon emissions to net zero by 2050. 'Net zero' means that the UK carbon account for the year 2050 is at least 100% lower than the net UK emissions of GHGs for the 1990 baseline. The Climate Change Act 2008 also requires the Secretary of State to set legally binding carbon budgets over five-year periods and to ensure that net UK carbon emissions do not exceed these budgets.
- 17.2.2 The carbon budgets which have been set or recommended to date, and which are relevant to this assessment, are discussed further in Section 17.7.

National policy

Nationally Determined Contributions

17.2.3 The UK's Nationally Determined Contribution (NDC) under the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC) commits the UK to reducing economy-wide GHG emissions by at least 68% by 2030 (UK Government, 2022) and 81% by 2035 (UK Government, 2024), compared to 1990 levels.

National Policy Statement for Water Resources Infrastructure

17.2.4 Key policies relevant to carbon set out in the NPS (Defra, 2023) are provided in Table 17.1.

Table 17.1 NPS requirements for carbon

Paragraph	Requirement within the National Policy Statement for Water Resources Infrastructure (Defra, 2023)	How the Project addressed this
4.4.11	While it is unlikely that any emissions increase from an individual development of water resources infrastructure will materially affect the government's ability to meet its emissions targets, the applicant should provide evidence of the climate impact of the development and an assessment of emissions associated with construction and operation against the water company's ability to deliver its contribution to the government's targets and commitments.	A preliminary estimate of the impact of the Project on the climate (i.e. potential changes in carbon emissions associated with the construction and operation of the Project), is provided in Section 17.8.
		An updated and refined estimate of the impact of the Project on the climate will be provided in the Environmental Statement (ES) (e.g. based on additional and updated information and including committed mitigation measures).
		The estimated changes in carbon emissions in the ES will also be assessed against relevant climate change commitments made by the Applicant.
4.4.12	Where there are residual emissions, the applicant should also provide evidence of the climate impact of the project (including embodied carbon), both from construction and operation, such that it can be assessed against the government's climate obligations. ^a	Preliminary estimates of residual changes in carbon emissions associated with the construction and operation of the Project are assessed against the government's climate obligations (i.e. the relevant UK carbon budgets) in Table 17.10.
		Updated and refined estimates of residual changes in carbon emissions associated with the construction and operation of the Project (e.g. based on additional and updated information and including committed mitigation measures) will be assessed against the government's climate obligations in the ES.
4.4.13	Evidence of appropriate mitigation measures (where appropriate incorporating engineering plans on configuration and layout, and use of materials) in design, construction and operation should be presented. The	Examples of embedded design (primary) mitigation measures which have been included in the design of the Project to reduce carbon emissions are summarised in Section 17.4.

Paragraph	Requirement within the National Policy Statement for Water Resources Infrastructure (Defra, 2023)	How the Project addressed this
	 applicant should demonstrate that it has investigated feasible options in terms of using: energy efficient technology or processes energy recovery technologies or processes renewable energy sources, produced either on site or linked to any local renewable energy initiatives greenhouse gas offsetting measures 	As set out in Section 17.9, to further reduce whole life carbon emissions associated with the Project, a Carbon and Energy Management Plan will be produced, aligning with the principles of PAS:2080 Carbon Management in Buildings and Infrastructure (British Standards Institution (BSI), 2023), and implemented. The Carbon and Energy Management Plan will inform the development of additional (secondary) mitigation measures so that carbon emissions associated with the Project are as low as reasonably practicable. These mitigation measures will be reported and accounted for (where relevant) in the ES.
4.4.14	 Examples of the mitigation that could be considered for the proposed development include: maximising the use of on-site materials, which could reduce Heavy Goods Vehicle (HGV) movements incorporating the use of energy efficient materials, building techniques and energy efficient pumping and water treatment equipment gravity fed transfers could require less energy requirements for pumping opportunities could be sought for the use of, or generation of, renewable energy to help offset additional operational carbon emissions offsetting through woodland creation on or adjacent to the site and registered with the Woodland Carbon Code 	Examples of the mitigation measures which are currently being considered for the Project are listed in Section 17.9, which include many of these suggestions.

^a Including the level of emissions and the impact of those on national and international efforts to limit climate change, both alone and where relevant in combination with other developments at a regional or national level, or sector level.

National Planning Policy Framework

- 17.2.5 Paragraph 8(c) of the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, 2024) includes an environmental objective to 'protect and enhance our natural, built and historic environment; including [...] mitigating and adapting to climate change, including moving to a low carbon economy.'
- 17.2.6 Paragraph 164(b) of the NPPF states that 'new development should be planned for in ways that ... help to reduce greenhouse gas emissions, such as through its location, orientation and design.'

Regional and local plans and policy

17.2.7 In addition to the national policy set out above, the Project must also have regard to relevant regional and local plans and policy.

The London Plan

- 17.2.8 Policy SI 2 'Minimising greenhouse gas emissions' in the London Plan (Mayor of London, 2021) states that major development should:
 - a. 'be net zero-carbon¹. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand'
 - b. 'include a detailed energy strategy to demonstrate how the zero-carbon target will be met'
 - c. 'calculate and minimise carbon emissions from any other part of the development, including plant or equipment'
 - d. 'calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.'

London Borough of Hounslow Local Plan

17.2.9 Policy EQ1 (Energy and Carbon Reduction) of the London Borough of Hounslow (LBH) Local Plan 2015-2030 (LBH, 2015) states that all developments are expected to '*meet the carbon emission reduction requirements set out in the London Plan.*'

London Borough of Hounslow Emerging Local Plan

17.2.10 The Local Plan review is currently underway, with the proposed submission version of the Hounslow Local Plan 2020-2041 (LBH, 2024) including a revised Policy EQ1 (Energy and Carbon Reduction) which states that all developments are expected to '*Meet the carbon emission reduction requirements set out in the London Plan to achieve net zero carbon development*' and '*Maximise on-site carbon reductions as far as possible, and set out all options pursued to achieve this within an Energy Statement*'. All major developments are expected to

¹ Defined in the London Plan as 'Activity that causes no net release of carbon dioxide and other greenhouse gas emissions into the atmosphere'.

'Investigate all options to reduce lifecycle carbon emissions (including but not limited to embodied carbon emissions).'

London Borough of Richmond upon Thames Local Plan

17.2.11 Policy LP 22 (Sustainable Design and Construction) of the London Borough of Richmond upon Thames (LBR) Local Plan (LBR, 2018) states, under '*Reducing Carbon Dioxide Emissions*' that '*Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation.*'

London Borough of Richmond upon Thames Emerging Local Plan

- 17.2.12 Policy 3 (Tackling the Climate Emergency) of the emerging LBR Local Plan (LBR, 2023) states that all development proposals will be required to 'reduce greenhouse gas emissions in accordance with the London Plan's Energy Hierarchy and support the transition to a low carbon society by maximising energy efficiency, zero and low carbon heat and local renewable energy generation', 'adopt a circular economy approach and minimise embodied carbon' and 'demonstrate how they will comply with all relevant policies on climate change and sustainable design during design, construction and operation of the development.'
- 17.2.13 Policy 4 (Minimising Greenhouse Gas Emissions and Promoting Energy Efficiency) states that '*To achieve the borough's target of net-zero carbon by 2043 at the latest, all proposed development will be required to demonstrate that the fullest contribution to minimising greenhouse gas emissions has been made on site.*'

Royal Borough of Kingston upon Thames Core Strategy

17.2.14 Policy CS1 (Climate Change Mitigation) of the Royal Borough of Kingston upon Thames (RBK) Core Strategy (RBK, 2012) states that '*The Council will* [...] *ensure that all development* [...] *is designed and built to make the most efficient use of resources, reduce its life cycle impact on the environment and contribute to climate change mitigation.*'

Royal Borough of Kingston upon Thames Emerging Local Plan

- 17.2.15 Draft Strategic Policy KC1 (Climate Change and Environmental Sustainability) of the draft Kingston's Local Plan (RBK, 2023) states that the Council will support development that 'delivers sustainable development over carbon offsetting', 'helps the borough to become net zero-carbon as part of a zero carbon London' and 'ensures efficient use of resources and minimises embodied carbon throughout its life cycle.'
- 17.2.16 Draft Strategic Policy KC7 (Minimising Greenhouse Emissions) of the draft Kingston's Local Plan (RBK, 2023) states that 'All proposed development must demonstrate that the fullest contribution to minimising greenhouse gas emissions has been made on site. This will be achieved by requiring [...] All development to reduce greenhouse gas emissions in operation and minimise

both annual and peak energy demand in accordance with the London Plan energy hierarchy.'

17.2.17 Draft Strategic Policy KC10 (Sustainable Construction and Supporting the Circular Economy) of Kingston's draft Local Plan (RBK, 2023) states that 'All development proposals are required to adopt a circular economy approach to building design and construction to reduce waste, keep materials and products in use for as long as possible, and minimise embodied carbon'. Furthermore it states that all development should 'Ensure resource efficiency and reduce embodied carbon emissions by sourcing and prioritising materials that can easily be maintained, repaired and renewed across the development lifetime' and 'Minimise the environmental impact of materials by specifying sustainablysourced, low impact and re-used or recycled materials; this should include identifying opportunities for the retention and reuse of existing materials on site (e.g. re-using demolition material on site). Materials should be locally-sourced wherever possible to minimise transport emissions.'

Plans and strategies

- 17.2.18 In 2019, the Applicant along with other water companies in England, pledged that its operational emissions would be net zero by 2030. The Applicant set out its roadmap to net zero in June 2021 which includes targets of net zero operational carbon by 2030 (Thames Water, 2021). This is consistent with the Net Zero 2030 Routemap developed by Water UK, the trade association for the water industry (Water UK, 2020).
- 17.2.19 Since then however, there have been some material changes to the assumptions used by the water sector which have a direct impact on the net zero challenge, including:
 - a. Changes to the Applicant's understanding of levels of N₂O associated with the wastewater treatment process
 - b. Increased operational emissions due to changes in reporting scope boundaries
 - c. Additional carbon impacts associated with increases in treatment standards
 - d. Government guidance to consider phasing of non-statutory commitments including Net Zero
- 17.2.20 Whilst these changes do not alter the Applicant's desire to achieve net zero, the Applicant intends to publish an updated net zero roadmap in 2025, after funding and priorities have been agreed with regulators.
- 17.2.21 The Price Review 2024 (PR24) methodology developed by The Water Services Regulation Authority (Ofwat) also includes requirements for water companies to reduce GHG emissions for the period 2025 – 2030 (Ofwat, 2024).
- 17.2.22 The LBH's Climate Emergency Action Plan 2020-2030 (LBH, 2020) sets out actions to reduce the council's own carbon emissions to net zero by 2030, as well as actions to reduce wider carbon emissions across the borough.

- 17.2.23 As set out in the LBR Climate Emergency Strategy 2019-2024 (LBR, 2019) and emerging Richmond Climate and Nature Strategy 2025-2030 (LBR, 2025), LBR aims to reach net zero carbon emissions as a borough by 2043.
- 17.2.24 Within its Climate Action Strategy 2024-2030, the RBK (RBK, 2024) has pledged to support the whole borough to work toward net zero carbon emissions by 2038.

Guidance

- 17.2.25 This assessment has been informed by the following key guidance documents:
 - a. PAS 2080:2023 Carbon Management in Buildings and Infrastructure (British Standards Institution (BSI), 2023)
 - b. Whole life carbon assessment for the built environment (Royal Institution of Chartered Surveyors (RICS), 2024)
 - c. British Standard (BS) EN 15978 Sustainability of construction works (BSI, 2011)
 - Institute of Environmental Management and Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance, 2nd Edition (Institute of Environmental Management and Assessment (IEMA), 2022)

17.3 Consultation, engagement and scoping

17.3.1 Table 17.2 presents the section of the Scoping Opinion (Planning Inspectorate, 2024) relating to carbon, and the Applicant's response to these comments.

PINS ID reference	Comment	Response
Planning Inspectorate (ID 3.10.4)	Embodied carbon in building materials from infrastructure replacement and refurbishment is proposed to be scoped out on the basis it is likely to be required beyond the project lifetime; the Scoping Report only proposes to scope matters within a 60 year lifetime, but Scoping Report paragraph 15.5.3 states that operation is likely to extend beyond 60 years. Additionally, whilst replacement is proposed to be scoped out in Scoping Report paragraph 15.5.3 this does not correlate with Table 15.3, which proposes to scope the matter in. On that basis, the Inspectorate does not agree to scope this matter out. The ES should assess significant effects associated with embodied carbon in building materials from replacement and refurbishment of infrastructure for the lifetime of the Proposed Development based on a worst-case scenario.	RICS guidance on 'Whole life carbon assessment for the built environment' (RICS, 2024) states that 'Module B5 [i.e. refurbishment] covers any refurbishment or change in performance of the asset (e.g. retrofit/refurbishment or extension) planned at the outset of the project to occur at some point after construction is completed.' No refurbishment or change in performance of the Project is currently planned to occur after construction within the assumed 60-year operational life of the Project. On this basis, there are no emissions associated with refurbishment. However, there will be carbon emissions
		associated with the periodic replacement of Project assets and materials within the assumed 60-year operational life of the Project. These emissions have therefore been estimated based on assumed replacement frequencies (see Appendix 17.1: Carbon Emissions Estimation Approach). These replacement emissions are considered worst-case as no allowance has been made for the future decarbonisation of

Table 17.2 Key scoping opinion comments for carbon

PINS ID reference	Comment	Response
		manufacturing processes (50% decarbonisation of replacement emissions could be assumed (RICS, 2024)).

- 17.3.2 Comments on the EIA Scoping Report relating to carbon were also received from LBR, including a request to take local targets for net zero into account. A preliminary comparison of relevant estimated carbon emissions associated with the Project against 'recommended' local carbon targets (see Table 17.6) has therefore been made, the results of which are set out in Section 17.8 and Table 17.10. Updated and refined estimates of relevant changes in carbon emissions associated with the Project (e.g. based on additional and updated information and including committed mitigation measures) will be compared against local targets for net zero in the ES.
- 17.3.3 LBR also stated that emissions from demolition should be scoped into the assessment. A preliminary estimate of the carbon emissions associated with the transport and treatment of waste materials associated with demolition activities undertaken during the construction phase of the Project is presented in Table 17.7. An updated estimate will also be included within the carbon assessment undertaken to inform the ES once further details regarding likely waste material quantities and disposal methods are known.
- 17.3.4 While LBR agreed that carbon emissions were correctly scoped in for both the construction and operation phases, LBR suggested that the emission sources which were scoped out in Table 15.3 of the EIA Scoping Report (namely lifecycle module A0 'Pre-construction' activities, lifecycle module B5 'Refurbishment' and lifecycle module B7 'Operational water') should be scoped in. However, the EIA Scoping Opinion (Planning Inspectorate, 2024) confirmed that carbon emissions associated with lifecycle modules A0 and B7 can be scoped out as they are likely to be negligible. Further justification as to why carbon emissions associated with lifecycle module B5 have been scoped out is provided in Table 17.2.
- 17.3.5 LBR also suggested that as well as the negative environmental impacts which will be assessed (i.e. the estimated increases in carbon emissions as a result of the construction and operation of the Project), the positive environmental impacts of the Project should be reported so they can also be considered. It is, however, not possible to accurately calculate the 'avoided' carbon emissions which would potentially be associated with alternative schemes or projects that may or may not be required to meet the identified 'need' for the Project. Furthermore, no such assessment is required by relevant planning policy such as the NPS. As such, the assessment has focused solely on the impact of the Project on climate (i.e. potential changes in carbon emissions as a result of its construction and operation).

- 17.3.6 LBR also requested that further detail be provided on:
 - a. How circular economy guidance and principles will be followed
 - b. How carbon emissions will be monitored and reported
 - c. The priority given to reducing carbon emissions associated with the construction and operation of the Project
 - d. Whether consideration is being given to on-site renewable energy generation
 - e. How the use of on-site materials will be maximised
- 17.3.7 Mitigation measures relevant to the items above are set out in Section 17.4 and 17.9 of this chapter as well as Section 11.4 of Chapter 11: Materials and Waste, while further detail will be provided on the above in the ES as more information becomes available.
- 17.3.8 Non-Statutory Public Consultation was undertaken from October 2023 to December 2023 to seek feedback about the site options for the Project from a variety of people such as landowners, residents, businesses, local authorities, and other statutory bodies who might be affected by or interested in the Project. In relation to carbon, issues raised were related to carbon emissions during the construction and operation phases of the Project and consequential impacts to climate.
- 17.3.9 On 26 July 2024, a pre-application meeting with regard to scoping of the carbon assessment for the ES was held with representatives from LBH, LBR and RBK via video link. The Applicant outlined the baseline environment in relation to carbon and proposed assessment methodology. Comments or questions during the meeting included queries around project alternatives, use of pumps and Project utilisation, with responses provided including information on the maintenance flow requirements for the Tertiary Treatment Plant (TTP), as set out in Chapter 2: Project Description. A query was also raised as to whether resource efficiency/circular economy principles would be followed, and it was confirmed that they would be, as set out in Chapter 11: Materials and Waste.
- 17.3.10 A further pre-application meeting was held with representatives from LBH, LBR and RBK via video link on 20 March 2025 at which the Applicant set out the proposed scope of the carbon assessment, the proposed approaches for taking local targets for net zero into account and for carbon management and reporting. Comments or questions during the meeting included a query regarding whether solar panels could be used to power pumps to which the Applicant responded that the potential for installing renewable energy sources (such as solar panels) on-site was still being considered.

17.4 Embedded design (primary) mitigation and standard good practice (tertiary)

Embedded design (primary) mitigation

- 17.4.1 The Applicant has worked through the design process to avoid or reduce environmental impacts through the Project design. This is referred to as embedded design (primary) mitigation. Chapter 3: Consideration of Alternatives details the design alternatives that have been considered, including the environmental factors which have influenced the decision making.
- 17.4.2 As set out in Chapter 3: Consideration of Alternatives, the design for the Project has been developed iteratively through the Regulators Alliance for Progressing Infrastructure Development (RAPID) gated process, from Gates 1 and 2 (development and assessment of initial options) through to Gate 3 (preferred scheme development). Design modifications resulting from the design development process which are likely to have reduced carbon emissions are also described below as embedded design (primary) mitigation.
- 17.4.3 Embedded design (primary) mitigation relevant to this aspect includes:
 - a. The location of the Tertiary Treatment Plant (TTP) close to the current final effluent channel (with a portion of the channel used in the TTP), which reduces the amount of infrastructure required to develop the Project. In addition, this channel is gravity fed and hence does not require additional pumping, which reduces both capital and operational emissions.
 - b. The use of a moving bed biofilm reactor (MBBR) instead of nitrifying sand filters (NSF) and Mechanical Filters (MF) for the treatment of final effluent to generate recycled water. This modification, which was made between Gate 2 and Gate 3, is considered likely to have reduced potential carbon emissions associated with the Project by:
 - i. Reducing chemical demand, thus reducing operational carbon emissions associated with the consumption and transportation of chemicals.
 - ii. Reducing embodied emissions associated with concrete chamber installation and water treatment materials. For example, NSFs require large volumes of specified sand and given the Project would only operate intermittently, it would be expected this sand would need to be replaced more frequently than the floating media used in MBBRs (which is also less carbon intensive).
 - iii. Reducing construction material quantities for the TTP platform as the MBBR system has a more compact footprint and weighs less than NSF.
 - c. The Standby Mode (also known as the sweetening or maintenance mode) flow of the Project (i.e. the volume of water run through the treatment facility to keep it in good working order when it is not in use) has been reduced from 18.75 megalitres per day at Gate 2 to 15 megalitres per day at Gate 3, which in turn reduces the pumping demand, thus reducing operational emissions during these conditions.
 - d. Embedded design (primary) mitigation to, where possible, reduce the disturbance and/or loss of existing carbon stores such as woodland and

vegetation within the draft Order limits and associated carbon emissions (as set out in Section 7.4 of Chapter 7: Terrestrial Ecology).

- e. Embedded design (primary) mitigation to reduce the consumption of raw materials and quantities of waste materials generated during the construction of the Project and associated carbon emissions (as set out in Section 11.4 of Chapter 11: Materials and Waste).
- f. Embedded design (primary) mitigation to reduce the number of road traffic movements generated during the construction phase of the Project and associated carbon emissions (as set out in Section 12.4 of Chapter 12: Traffic and Transport).

Standard good practice (tertiary)

- 17.4.4 Standard good practice (tertiary) would occur as a matter of course due to legislative requirements or standard sector practice. For the carbon aspect this includes:
 - a. Standard good practice (tertiary) to reduce the number of road traffic movements generated during the construction phase of the Project and associated carbon emissions (as set out in Section 12.4 of Chapter 12: Traffic and Transport).
 - b. Standard good practice (tertiary) to reduce the consumption of raw materials and quantities of waste materials generated during the construction of the Project and associated carbon emissions (as set out in Section 11.4 of Chapter 11: Materials and Waste). This includes applying circular economy principles and the submission of a Circular Economy Statement.
 - c. Standard good practice (tertiary) to, where possible, reduce the disturbance and/or loss of existing carbon stores such as woodland and vegetation within the draft Order limits and associated carbon emissions (as set out in Section 7.4 of Chapter 7: Terrestrial Ecology).

17.5 Assessment methodology

General approach

Assessment scope

- 17.5.1 The carbon assessment and approach to mitigation has followed the whole-life carbon principles of PAS 2080:2023 (BSI, 2023), a globally applicable standard for managing carbon in buildings and infrastructure. In line with IEMA guidance (IEMA, 2022), calculations of carbon emissions have used data consistent with the whole-life carbon modular approach and lifecycle stages and modules defined in BS EN 15978 (BSI, 2011). The assessment has included construction (including any demolition) and operation.
- 17.5.2 A preliminary estimate has been made of carbon emissions which are likely to be generated during the construction phase for the following activities:
 - a. Embodied carbon emissions associated with raw material supply, transport and manufacturing of the required materials and assets (product stage (modules A1–A3))

- b. Transport of materials to the construction site (construction process stage (module A4))
- c. Transport of waste from the construction site and subsequent treatment (construction process stage (module A5))
- d. Transport of construction workers, on-site staff and visitors to and from the construction site (construction process stage (module A5))
- e. Operation of construction plant and on-site activities (construction process stage (module A5))
- 17.5.3 An estimate has also been made of carbon emissions which are likely to be generated during the operational phase as a result of the following activities:
 - a. Maintenance, repair and replacement of Project assets over its operational life (modules B2–B4)
 - b. Operational energy use (module B6)
 - c. Purchase and use of chemicals (module B8)
- 17.5.4 As noted in Table 17.2, refurbishment of Project assets (module B5) is not anticipated within the assumed 60-year operational life. On this basis, the carbon emissions for this module are zero.
- 17.5.5 As noted in paragraph 17.5.22, however, it has not been possible to estimate carbon emissions associated with all construction and operation phase activities at the time of writing this PEI Report chapter. Estimated emissions associated with the following activities will therefore be considered additionally in the ES:
 - a. On-site consumption of fuel, electricity and water (construction process stage (module A5))
 - b. Process emissions (module B8)
- 17.5.6 The recent Supreme Court judgment on the Finch case (Finch v Surrey County Council [2024] UKSC 20) has been considered in the development of the proposed scope and methodology for the carbon assessment. Where practicable and appropriate therefore, relevant 'upstream' and 'downstream' direct and indirect carbon emissions have been considered or are inherent within the methodology followed. For example, the assessment considers 'upstream' carbon emissions associated with the raw material supply, manufacturing and transport of construction materials for the construction phase. It also considers upstream emissions associated with the production and consumption of fuels and electricity during both construction and operation. 'Downstream' emissions such as those associated with the transport and treatment of construction waste are also considered.
- 17.5.7 The operation of the Project is not expected to result in additional 'downstream' emissions associated with the consumption or use of the Project's output by others as the Project would only operate intermittently to address a forecast deficit in water supply during drought conditions.

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Temporal scope

- 17.5.8 Carbon emissions associated with the Project have been estimated and reported for the construction phase and operational phase (over an assumed 60-year operational lifetime). Therefore, the temporal scope of the assessment covers the construction period (i.e. 2029 to 2032), commissioning and performance testing (2032) and the operational period 60 years after the opening year of the Project (i.e. 2033 2092).
- 17.5.9 As discussed in Section 2.9 (Decommissioning) of Chapter 2: Project Description, there are no plans to decommission the Project and decommissioning was scoped out of the assessment (Planning Inspectorate, 2024). As such, carbon emissions associated with decommissioning have not been assessed.

Baseline conditions

- 17.5.10 A baseline is a reference point against which a new project can be compared and assessed to report its net carbon impact.
- 17.5.11 As the Project is a new vital drought resilience project for London, existing and future baseline emissions without the Project are assumed to be zero. This assumption is worst-case, as in reality there would be carbon emissions associated with the provision of additional water supplies during periods of drought in the absence of the Project (although as noted in paragraph 17.3.7, it is not possible nor necessary to estimate these 'avoided' emissions).
- 17.5.12 Estimated changes in carbon emissions as a result of the Project have therefore been contextualised in terms of future baseline trajectories towards net zero carbon emissions that have been set at:
 - a. National level (as a result of legislation)
 - b. Sectoral level (as a result of commitments made by UK water companies such as the Applicant)
 - c. Local level (based on levels recommended by climate scientists (see Section 17.7 and Table 17.6))

Emissions estimation approach

- 17.5.13 At this stage, a preliminary, high-level estimate has been made of potential changes in carbon emissions associated with the construction and operation of the Project. This preliminary assessment should be considered indicative because:
 - a. A 'top-down' estimation approach has been followed using tools developed by the Applicant (the Thames Water Engineering Estimating System (EES) models), which estimate embodied carbon emissions based on the type and number of proposed assets and carbon factors derived from previous similar projects. Such approaches are typically used to compare options or estimate the impacts of design changes at earlier project stages where more limited design information is available. Within the ES a more detailed

and refined calculation approach will be followed (as described in Table 17.3 and Table 17.4).

- b. It has not been possible to estimate carbon emissions associated with all emission sources at this stage due to the required data not being available, as further work is required to develop the information necessary to accurately estimate emissions. For example, it has not been possible to estimate operational process emissions and the on-site consumption of fuel, electricity and water (e.g. associated with site offices and welfare facilities). These emission sources will be considered in the ES when further data are available.
- c. The design of the Project continues to be refined, therefore, the design assessed at this stage may vary from that which will be assessed within the ES.
- d. Whilst the embedded design (primary) mitigation measures described in Section 17.4 have been allowed for within this preliminary estimate, further measures to reduce carbon emissions may subsequently be embedded into the design of the Project which will therefore be accounted for within the ES.
- e. The estimates were made using relevant carbon factors available in April 2025, however, carbon factors are updated periodically (e.g. annually), and therefore, more up-to-date carbon factors will likely be used for some emission sources within the assessment presented in the ES.
- 17.5.14 Summaries of the emissions estimation approaches taken at this PEI Report stage, along with the approaches which are proposed to be followed within the ES, are provided in Table 17.3 and Table 17.4 for the construction and operation phases, respectively. Further relevant details on the approaches used to inform this PEI Report are provided in Appendix 17.1: Carbon Emissions Estimation Approach.

Table 17.3 Summary o	of construction phase carbor	emissions estimation approach	for PEI Report and proposed	d approaches for ES

Emission source /	Approach for PEI Report		Proposed approach for ES	
Module	Method / tool	Data	Method	Data
Product stage (embodied carbon in construction materials) Modules A1-A3	Thames Water EES models	Types and quantities of key assets for the Project	Carbon factors from Inventory of Carbon & Energy (ICE) Database v4.0 (Circular Ecology, 2024) Carbon curves derived from assessments undertaken for previous similar projects or relevant environmental product declarations (EPDs)	Types and quantities of materials, assets and items for the Project
Transport of construction materials to site Module A4	UK Government GHG Conversion Factors for Company Reporting (Department for Energy Security and Net Zero (DESNZ), 2024a)	Estimated masses of key construction materials for the Project Assumed transportation distances	As for PEI Report	As for PEI Report
Fuel consumption (employee transport) Module A5	UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated total distance travelled to and from the construction site based on expected numbers of employees over the construction period and assumptions regarding distances travelled and modes used	As for PEI Report	As for PEI Report
Fuel and electricity consumption (on-site plant and machinery)	UK Government GHG Conversion Factors for	Estimated fuel and electricity consumption	As for PEI Report	As for PEI Report

Emission source /	Approach for PEI Report		Proposed approach for ES	
Module	Method / tool	Data	Method	Data
Module A5	Company Reporting (DESNZ, 2024a)			
On-site electricity, gas and water consumption (e.g. associated with site offices and welfare facilities) Module A5	Not assessed	Not applicable	UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated electricity, gas and water consumption
Treatment and disposal of waste materials Module A5	UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated types and quantities of waste materials generated during the construction of the Project (e.g. demolition waste and excavated materials) Types and quantities of materials, assets and items required to construct the Project and assumed wastage rates Assumed disposal methods	As for PEI Report	As for PEI Report
Transport of waste materials from site Module A5	UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated masses of waste materials Assumed transportation mode and distance	As for PEI Report	As for PEI Report

Emission source /	Approach for PEI Report		Proposed approach for ES	
Module	Method / tool	Data	Method	Data
Maintenance Module B2	1% of estimated carbon emissions for modules A1–A5 (as per RICS guidance (RICS, 2024))	Estimated construction phase carbon emissions for modules A1-A5	As for PEI Report	As for PEI Report
Repair Module B3	25% of B2 maintenance emissions for relevant items except for mechanical, electrical, and plumbing items, where 10% of estimated A1–A3 carbon emissions assumed (as per RICS guidance (RICS, 2024))	Estimated operation phase B2 maintenance carbon emissions / A1- A3 emissions	As for PEI Report	As for PEI Report
Replacement (embodied carbon in replacement materials) Module B4	Thames Water EES models	Types and quantities of key assets Assumed replacement frequencies	Carbon factors from Inventory of Carbon & Energy (ICE) Database v4.0 (Circular Ecology, 2024) Carbon curves derived from assessments undertaken for previous similar projects or relevant EPDs	Types and quantities of materials, assets and items for the Project Assumed replacement frequencies of materials, assets and items
Replacement (transportation of replacement materials)	Ratio of estimated transport and construction process emissions for	Estimated embodied carbon in replacement materials	UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated masses of replacement materials, assets and items

Table 17.4 Summary of operation phase carbon emissions estimation approach for PEI Report and proposed approaches for ES

Emission source /	Approach for PEI Report		Proposed approach for ES	
Module	Method / tool	Data	Method	Data
Module B4	construction phase (Modules A4 and A5) to embodied carbon in construction materials (Modules A1-A3)			Assumed transportation distances
Replacement (fuel consumption during replacement processes) Module B4			UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated fuel consumption during replacement activities
Replacement (waste treatment) Module B4			UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated types and quantities of waste materials generated during replacement activities Assumed disposal methods
Replacement (waste transport) Module B4			UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2024a)	Estimated masses of waste materials / assets Assumed transportation distances
Emissions associated with electricity consumption Module B6	Electricity consumption based emission factors (Department for Energy Security and Net Zero (DESNZ), 2023)	Anticipated annual electricity consumption based on the number of items of electrical equipment (e.g. pumps), wattage and operating schedule of the Project	As for PEI Report	As for PEI Report
Process emissions Module B8	Not assessed	Not applicable	To be confirmed (see paragraph 17.5.24)	To be confirmed (see paragraph 17.5.24)

Emission source /	/ Approach for PEI Report		Approach for PEI Report Proposed approach for ES	
Module	Method / tool	Data	Method	Data
Consumption of chemicals Module B8	Carbon Accounting Workbook (CAW) v18 emission factors (UK Water Industry Research, 2024)	Estimated quantities of chemicals used per year	As for PEI Report	As for PEI Report

17.5.15 Further details on the methodology, activity data and carbon factors used for each source will be provided in the ES.

Assessing the significance of effects

- 17.5.16 There is no set significance threshold for changes in emissions of carbon. IEMA (2022) guidance indicates that the crux of significance is not whether a development emits carbon, nor even the magnitude of carbon emissions, but whether the development contributes to reducing carbon emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.
- 17.5.17 The adoption of a net zero target, however, does not mean that consent cannot be granted for a development that will increase carbon emissions, for as stated in paragraph 4.4.15 of the NPS 'any increase in greenhouse gas emissions from the project alone is not a reason to refuse development consent for infrastructure to secure water supplies'. Instead, and again as stated in paragraph 4.4.15 of the NPS, it is necessary to evaluate whether 'the increase in greenhouse gas emissions resulting from the project is so significant that it would have a material impact on the ability of the government to meet its greenhouse gas reduction obligations and commitments including but not limited to, net zero, the Nationally Determined Contribution and carbon budgets.'
- 17.5.18 In light of the above, an initial assessment has been made, based on professional judgement, as to whether increases in carbon emissions as a result of the Project could have a material impact on the ability of the UK Government to meet its carbon reduction targets.
- 17.5.19 The IEMA (2022) guidance recognises, however, that the contribution of most individual projects to national-level budgets will be small, and therefore suggests it is good practice to draw on multiple sources of evidence when evaluating the context of carbon emissions associated with a project. The IEMA (2022) guidance also indicates that where a quantified carbon budget or net zero trajectory is lacking, a more qualitative or policy-based approach to contextualising emissions to evaluate significance, may be necessary.
- 17.5.20 As such, estimated Project related carbon emissions have additionally been considered in the context of:
 - a. The Applicant's own climate change policy (paragraphs 17.2.18 to 17.2.20)
 - b. 'Recommended' carbon budgets derived for the relevant local authorities (Table 17.6)
- 17.5.21 Table 17.5 provides significance of effect descriptions from the IEMA (2022) guidance which have been used to assist the judgement of significance. In line with the IEMA guidance, effects that are deemed to be 'significant' are those where the magnitude is moderate or major adverse. Magnitudes of minor adverse or negligible are considered to represent an effect which is 'not significant'. The determination of magnitude has included contextualising estimated carbon emissions against the UK carbon budgets and, where

relevant, against water sector based and more localised carbon emissions reduction targets and policy.

Table 17.5 Significance criteria

Magnitude	Assessment criteria
Major Adverse	A project's carbon impacts are not mitigated or are only compliant with do- minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for such types of projects. A project with major adverse effects is locking-in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
Moderate Adverse	A project's carbon impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for such types of projects. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
Minor Adverse	A project's carbon impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for such types of projects. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
Negligible	A project's carbon impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for such types of projects, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Beneficial	A project's net carbon impacts are below zero, compared to the without- project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

Source: Derived from Institute of Environmental Management and Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance, 2nd Edition (IEMA, 2022)

Assumptions and limitations

- 17.5.22 As noted in paragraph 17.5.3, at this stage, it has not been possible to undertake a full and detailed estimate of carbon emissions associated with the construction and operation of the Project due to some of the required information not yet being available and/or at a sufficient level of detail. This is because further work is required to develop the information necessary to accurately estimate emissions. While the carbon emissions estimates presented in this assessment should, therefore, be considered preliminary and indicative, the largest sources of carbon emissions associated with the Project (e.g. embodied carbon in construction and replacement materials) have been considered, albeit using a more simplistic approach.
- 17.5.23 As this PEI Report is based on an early design for the Project, a 15% contingency factor has been applied to estimated carbon emissions for all

lifecycle stages and modules within this assessment (as recommended by RICS (RICS, 2024)) to provide a more conservative assessment. Within the ES, further, more detailed consideration will be given to the level of uncertainty associated with the estimated changes in carbon emissions presented therein.

17.5.24 It is recognised that the TTP within the Project will result in emissions of N₂O, which is a GHG with a high GWP. However, there are difficulties and uncertainties associated with estimating emissions of N₂O from water treatment processes. As such, the Applicant is currently considering the most appropriate approach for estimating N₂O emissions for inclusion within the ES.

17.6 Study area

- 17.6.1 For carbon, the receptor is the global climate, as all emissions, regardless of where they occur, contribute to the concentration of GHGs in the atmosphere and associated global warming. As such, the following study areas are defined for the emission sources which are considered within this assessment:
 - a. The carbon emissions resulting from construction this is the study area necessary to consider all of the carbon emissions embodied within construction materials (i.e. GHGs generated during the manufacture of raw materials) and their associated transport to site from the supplier. It also includes carbon emissions associated with construction activities carried out within the draft Order limits and those associated with workers travelling to and from the draft Order limits and the transport and processing of waste offsite for reuse, recycling, treatment, or disposal. As such, the study area is defined by the greatest extent of these activities, some of which, it is assumed, may occur at a national scale (i.e. within the UK).
 - b. The carbon emissions resulting from operation and maintenance the study area is based on a similar extent as the construction phase (e.g. to include replacement of assets which may be delivered from suppliers located across the UK). It also includes the carbon emissions from the chemicals and energy consumed within the draft Order limits required to operate the Project and carbon emissions from any on-site processes associated with the operation of the Project.

17.7 Baseline conditions

Existing baseline

- 17.7.1 In 2023 (the latest year for which data were available at the time of writing), UK net GHG emissions were estimated at 385 million tonnes of carbon dioxide equivalent (MtCO₂e), down 5% from 2022 and 53% from 1990 (DESNZ, 2025).
- 17.7.2 Emissions associated with the water supply and sewerage sector (including natural water, water treatment and supply services, sewerage services and sewage sludge) are estimated to have accounted for approximately 3.1 MtCO₂e in 2022 (the latest year for which data were available at the time of writing), (approximately 0.8% of the UK total in 2022) (DESNZ, 2024b).

17.7.3 The Applicant's net operational emissions for the financial year 2023/24 were 350,400 tonnes of carbon dioxide equivalent (Thames Water, 2024)².

Future baseline

National level

- 17.7.4 Future carbon emissions relevant to the Project at a national level are defined by the five-yearly UK carbon budgets that have been set to date (and which define the UK's planned trajectory to net zero).
- 17.7.5 The UK Government carbon budgets that have been set to date and which are relevant to the Project, are as follows:
 - a. The fifth carbon budget: 2028 2032 defined within The Carbon Budget Order 2016 1,725MtCO₂e, equivalent to a 57% reduction in annual emissions from a 1990 baseline.
 - b. The sixth carbon budget: 2033 2037 defined within The Carbon Budget Order 2021 – 965MtCO₂e, equivalent to a 78% reduction in annual emissions from a 1990 baseline. It is also the first budget which is in line with the 2050 net zero carbon target.
- 17.7.6 In February 2025 the Climate Change Committee advised the UK on the level of its seventh carbon budget, the legal limit for UK net emissions of GHGs over the years 2038 to 2042 (Climate Change Committee, 2025). Whilst the 'recommended' seventh carbon budget is yet to be adopted by the UK government, it has been considered in this PEI Report on a precautionary basis.

Sectoral level

17.7.7 As noted in paragraph 17.2.18, in 2019 the Applicant, along with other water companies in England, pledged to achieve net zero operational carbon emissions by 2030. Estimated changes in operational carbon emissions as a result of the Project have therefore been considered in the context of this commitment.

Local level

17.7.8 In the absence of statutory carbon budgets at a local authority level and in order to help contextualise changes in carbon emissions as a result of the Project at a local level, 'recommended' carbon budgets have been derived for the LBH, the LBR and the RBK using the Tyndall Centre's Carbon Budget Reports tool (Tyndall Centre for Climate Change Research, 2025). The 'recommended' carbon budgets derived are shown in Table 17.6.

² Operational emissions include the Thames Water 'appointed business' direct emissions from burning of fossil fuels, process and fugitive emissions from its water treatment, wastewater and bioresources/sludge management facilities, transport of company-owned vehicles and electricity to operate facilities and head office. It also includes emissions from purchased goods and services, business travel, waste treatment, etc. Emissions from capital carbon (i.e. construction and replacement of infrastructure and assets) are not included within these operational emissions).

- 17.7.9 The Carbon Budget Reports tool (Tyndall Centre for Climate Change Research, 2025) can be used to calculate carbon budgets for any part of the UK from local authority area scale, up to regions and devolved administrations. The carbon budgets derived translate the 'well below 2°C and pursuing 1.5°C' global temperature target and equity principles in the United Nations Paris Agreement (United Nations, 2015) to sub-national areas within the UK.
- 17.7.10 It should be noted, however, that while IEMA guidance (IEMA, 2022) suggests such budgets may be a more pertinent scale for individual projects and local decision making, it also notes that the effects of carbon emissions are not geographically circumscribed, so a geographic budget (below a defined national budget based on the negotiated NDC commitments to a global budget agreed through the UNFCCC) is *'not very meaningful'*. The IEMA guidance also recognises that it is unclear whether such local authority or regional budgets will add up coherently to UK carbon budgets.
- 17.7.11 Furthermore, the budgets derived using the Carbon Budget Reports tool (Tyndall Centre for Climate Change Research, 2025) are for CO₂ only and therefore do not account for emissions of other GHGs. While they include emissions from fossil fuel combustion within each area and a share of the emissions from national electricity generation, they also specifically exclude emissions associated with cement production.

Carbon budget period	'Recommended' carbon budget (MtCO ₂)
2028 - 2032	2.6
2033 - 2037	1.3
2038 - 2042	0.7
2043 - 2047	0.4
2048 - 2100	0.4

Table 17.6 'Recommended' carbon budgets for LBH, LBR and RBK

Source: Tyndall Carbon Budget Reports - Quantifying the implications of the United Nations Paris Agreement for local areas (Tyndall Centre for Climate Change Research, 2025)

Climate change

17.7.12 In general, climate change is expected to lead to an increase in temperatures, with a greater frequency of hotter, drier summers and warmer, wetter, winters. Climate change is also expected to lead to sea level rise which will affect tide levels and associated flood risk within the tidal section of the River Thames as far west as Teddington Weir. Further information on projected changes in climate parameters is provided in Chapter 18: Climate Change. Projected future changes in climate (e.g. increase in temperatures) have the potential to interact with effects identified within some environmental topics and exacerbate or diminish their impact. Such combined impacts are termed In-Combination Climate Impacts (ICCI). Consideration of the potential ICCI associated with carbon is provided in Section 17.8 of this chapter.

17.8 Preliminary assessment of likely significant effects

Construction phase

- 17.8.1 This section sets out the likely significant effects on carbon during construction. The assessment assumes that embedded design (primary) mitigation and standard good practice (tertiary) measures in the Code of Construction Practice are in place.
- 17.8.2 Estimated construction phase carbon emissions associated with the Project are shown in Table 17.7. Further relevant details on the approaches used to inform this PEI Report are provided in Appendix 17.1: Carbon Emissions Estimation Approach.
- 17.8.3 These estimates indicate that the majority of construction phase carbon emissions are associated with the embodied carbon in construction materials (71%) while the transportation of waste materials from site is estimated to make a sizeable contribution (10%).

Emission source / Module	Estimated carbon emissions (tCO _{2e})
Product stage (embodied carbon in construction materials) Modules A1-A3	31,101
Transport of construction materials to site Module A4	2,104
Fuel consumption (employee transport) Module A5	2,256
Fuel and electricity consumption (on-site plant and machinery) Module A5	3,274
On-site electricity, gas and water consumption (e.g. associated with site offices and welfare facilities) Module A5	Not assessed at this stage (paragraph 17.5.22)
Treatment and disposal of waste materials Module A5	576
Transport of waste materials from site Module A5	4,407
Total	43,717

Table 17.7 Estimated construction phase carbon emissions

Operation phase

17.8.4 Estimated operation phase carbon emissions associated with the Project are shown in Table 17.8. Further relevant details on the approaches used to inform

this PEI Report are provided in Appendix 17.1: Carbon Emissions Estimation Approach.

17.8.5 These estimates indicate that the majority of operation phase carbon emissions are associated with the periodic replacement of materials and assets (65%) and the consumption of chemicals (23%). Emissions associated with operational energy consumption are, however, only estimated to make a relatively minor contribution (8%) due to the projected decarbonisation of the national grid over time.

Emission source / Module	Estimated carbon emissions (tCO _{2e}) over assumed operational lifetime (2032 – 2092)
Maintenance	437
Module B2	
Repair	109
Module B3	
Replacement	8,861
Module B4	
Operational energy	1,640
Module B6	
Process emissions	Not assessed at this stage
Module B8	(see paragraph 17.5.24)
Chemical consumption	3,516
Module B8	
Total	14,563

Table 17.8 Estimated operation phase carbon emissions

Comparison with national carbon budgets

- 17.8.6 Estimated net changes in carbon emissions associated with the Project over relevant time periods are shown in Table 17.9 and compared to UK carbon budgets.
- 17.8.7 The construction phase carbon emissions are estimated to occur entirely in the fifth carbon budget period, along with a single year of emissions associated with commissioning and performance testing. Emissions generated during the first five years of full operation (2033 2037) are estimated to occur in the sixth carbon budget period and operation emissions between 2038 2042 in the seventh carbon budget period.

Project stage	Total estimated net change in carbon emissions	Estimated net change in carbon emissions with the Project within relevant UK carbon budget period (tCO ₂ e) (and as % of relevant UK carbon budget)				
	(tCO ₂ e)	Fifth carbon budget (2028–2032)	Sixth carbon budget (2033–2037)	Recommended seventh carbon budget (2038–2042)		
Construction	43,717	43,717 (0.0025%)	-	-		
Operation	14,361	202 (<0.0001%)	1,534 (0.0002%)	1,426 (0.0003%)		
Total	58,280	43,919 (0.0025%)	1,534 (0.0002%)	1,426 (0.0003%)		

Table 17.9 Estimated carbon emissions compared to UK carbon budgets

17.8.8 The results in Table 17.9 indicate that estimated changes in carbon emissions as a result of the Project are extremely small in comparison to relevant UK carbon budgets. On this basis, carbon emissions associated with the Project are considered unlikely to have a material impact on the ability of the UK Government to meet its carbon reduction targets.

Comparison with local carbon targets

- 17.8.9 Estimated net changes in carbon emissions within carbon budget periods are also shown in Table 17.10 for comparison to 'recommended' local carbon budgets. It should be noted, however, that the following sources of emissions associated with the Project have been excluded from this comparison:
 - a. Embodied carbon in construction materials, as such emissions are primarily associated with embodied carbon in concrete (whereas emissions associated with the production of cement are specifically excluded from the 'recommended' carbon budgets described in Table 17.6) and steel, neither of which will be produced locally.
 - b. Carbon emissions associated with operational repair, maintenance and replacement activities for the same reasons given for embodied carbon in construction materials above.
 - c. Waste treatment (which has been assumed to occur outside the areas of the LBH, the LBR and the RBK).
 - d. Transportation emissions outside of the local area (i.e. over 20km from the Project).
 - e. Carbon emissions associated with the consumption of chemicals during operation, as such chemicals are considered very unlikely to be manufactured locally.

- f. Process emissions from the TTP, which would be emitted in the form of N₂O, whereas the 'recommended' carbon budgets are for CO₂ only (not CO₂e), and therefore do not include N₂O emissions.
- 17.8.10 As such, this comparison only includes estimated carbon emissions associated with the following:
 - a. The transportation of construction and waste materials and on-site employees and construction workers over a distance of 20km
 - b. Fuel and electricity consumed by on-site plant and machinery
 - c. Electricity consumption during the operation of the Project

Table	e 17.10	Relevant	estimated	Project	carbon	emissions	compared to	'recommende	d'
local	carbon	budgets							

Project stage	Relevant estimated Project carbon emissions within relevant carbon budget period (tCO _{2e}) (and as % of relevant 'recommended' local carbon budget)					
	2028–2032	2033–2037	2038–2042	2043–2047	2048–2092	
Construction	6,003 (0.231%)	-	-	-	-	
Operation	144 (0.005%)	462 (0.036%)	354 (0.051%)	170 (0.042%)	510 (0.128%)	
Total	6,146 (0.236%)	462 (0.036%)	354 (0.051%)	170 (0.042%)	510 (0.128%)	

- 17.8.11 The results in Table 17.10 indicate that estimated changes in carbon emissions as a result of the Project are extremely small in comparison to 'recommended' local carbon budgets.
- 17.8.12 It should be noted that within the ES, the comparison shown in Table 17.10 will be updated to include estimated carbon emissions during construction and replacement activities associated with on-site electricity, natural gas and water consumption (e.g. associated with site offices and welfare facilities).

Significance of effects

- 17.8.13 Section 17.4 describes embedded design (primary) mitigation and standard good practice (tertiary) which will reduce carbon emissions during construction and operation of the Project. Furthermore, the comparisons to national and local carbon budgets set out above, indicate that changes in carbon emissions associated with the construction and operation of the Project are unlikely to have a material impact on these being met. In addition, many of the measures in Section 17.4 will contribute towards the Applicant's own net zero operational emissions target, as discussed in Section 17.2.
- 17.8.14 The changes in carbon emissions set out above are, however, only partially mitigated. Whilst they could be considered to meet the applicable policy

requirements, they would not fully contribute to decarbonisation in line with local and national policy goals for such types of project. Therefore, in accordance with the significance criteria set out in Table 17.5, the estimated changes in carbon emissions associated with the Project set out above would fall short of fully contributing to the UK's trajectory towards net zero, including the Applicant's own aspiration to achieve net zero operational emissions. As such, these impacts would represent a moderate adverse significant effect.

17.8.15 As discussed in Section 17.9, therefore, additional (secondary) mitigation measures are proposed so that carbon emissions are as low as reasonably practicable and so more fully align with planning policy and climate change commitments, including the Applicant's own policies relating to carbon management.

Cumulative effects

- 17.8.16 No separate assessment of potential cumulative effects is considered necessary for this aspect for the following reasons:
 - a. Carbon is different to other environmental aspects in that the spatial location of the effect is not important, as any emission of carbon will have the same effect on the receptor of concern (i.e. the global climate), no matter where it is released.
 - b. Because of the above, there is no basis for selecting any particular project or projects that have carbon emissions for cumulative assessment over any other.
 - c. The assessment presented is inherently cumulative in that the carbon budgets presented herein, and against which estimated carbon emissions associated with the Project are compared, represent expected emissions of carbon from all sectors of the UK economy over the relevant time period.

In-Combination Climate Impacts

- 17.8.17 During the construction phase of the Project, potential climate-related impacts (e.g. very high temperatures, heavy rainfall and/or flooding) have the potential to disrupt, delay or extend construction activities, potentially resulting in an increase in carbon emissions associated with construction activities (e.g. as a result of the increased use of raw materials and/or electricity, fuel and/or water consumption).
- 17.8.18 During the operation phase of the Project, potential climate-related impacts (e.g. very high temperatures, increased/extended drought periods, heavy rainfall and/or flooding) could result in:
 - Increased repair, maintenance and/or replacement of materials and assets (e.g. due to increased degradation of materials and/or damage during extreme climate events)
 - b. Increased electricity and/or chemical consumption should the Project need to operate more frequently and/or over longer periods than expected

17.8.19 Further details of potential ICCI are provided in Appendix 18.1: In-Combination Climate Impacts.

17.9 Additional (secondary) mitigation and enhancement measures

Additional (secondary) mitigation

- 17.9.1 Mitigation measures are defined in Chapter 4: Approach to Environmental Assessment. Embedded design (primary) mitigation and standard good practice (tertiary) specific to this aspect are provided in Section 17.4 of this chapter.
- 17.9.2 In order to further reduce whole life carbon emissions associated with the Project, a Carbon and Energy Management Plan will be produced, aligning with the principles of PAS 2080:2023 Carbon Management in Buildings and Infrastructure (BSI, 2023). The Carbon and Energy Management Plan will include:
 - a. A defined whole-life carbon baseline and level of ambition for carbon reduction
 - b. The identification of carbon 'hotspots' and potential carbon reduction opportunities which will be taken forward for further consideration
 - c. How carbon will be monitored and reported over the lifecycle of the Project (Appendix 4.2 Commitments Register, Provisional Commitment Reference (PCR) PCR 60)
- 17.9.3 An outline Carbon and Energy Management Plan, summarising the key elements of the document, will be submitted as part of the DCO Application.
- 17.9.4 The outline Carbon and Energy Management Plan will also demonstrate:
 - a. How emissions associated with operational energy consumption have been minimised for the Project, with reference to the London Plan's Energy Hierarchy
 - b. That the Applicant has investigated feasible options in terms of using:
 - i. Energy efficient technologies or processes
 - ii. Energy recovery technologies or processes
 - iii. Renewable energy sources, produced either on-site or linked to any local renewable energy initiatives
 - iv. Carbon offsetting measures (PCR 61)
- 17.9.5 Potential mitigation measures which will be considered going forward as part of the Carbon and Energy Management Plan include, but are not limited to, where practicable (PCR 62):
 - a. Maximising the use of on-site materials, which could reduce HGV movements
 - b. Reducing the distances over which raw materials are transported to site by sourcing materials from local suppliers

- c. Reducing the distances over which waste materials are transported off-site by identifying sites for waste treatment and/or re-use within the local area
- d. Transporting materials to site and / or waste materials off-site using lower carbon forms of transport (e.g. by rail or river), as opposed to by road
- e. Using electric (or alternative lower-carbon fuel) construction equipment instead of conventional diesel-powered construction plant
- f. Providing electric vehicle charging points in the site compound(s)
- g. Using construction vehicles fitted with telematics and start/stop technology
- h. Using on-site renewable energy generation and storage to reduce diesel generator use and power taken from the grid during construction
- i. Using low resource and low energy solutions for site compounds, offices and welfare facilities
- j. Ensuring the availability of grid connections for site compounds (facilitating access to lower carbon-intensity energy from grid electricity)
- k. Using alternative, low carbon fuels for modes of transport of materials to site, if available
- I. Encouraging construction workers to travel to site using public transport and/or active travel options as opposed to private cars (e.g. by providing shuttle buses to nearby stations, secure cycle storage and appropriate welfare facilities to accommodate cyclists and other active travel users)
- m. Reducing or avoiding, where practicable, the use of carbon intensive materials (e.g. concrete and cement), and where this is not practicable, substituting carbon intensive materials with lower carbon intensity replacements (within the bounds of relevant design standards for safety and quality), for example through early contractor involvement in the design development process
- n. Potentially, requiring contractors to submit Carbon Reduction Plans in tenders to encourage competition and innovation in terms of carbon reduction
- o. Incorporating the use of energy-efficient materials, building techniques and energy-efficient pumping and water treatment equipment
- p. Gravity-fed transfers, which could require less energy requirement for pumping
- q. Improving energy management and efficiency during operation (e.g. metering, smart control systems and catchment level analytics)
- r. Improving operational resource efficiency and chemical supply (e.g. by reducing chemical use and using supply chain contracts to procure lower-carbon chemicals)
- s. Operation and maintenance optimisation (e.g. by enhanced maintenance of mechanical and electrical assets to reduce replacement frequencies, optimised operational parameters and less frequent filter media replacement)
- t. Generating electricity on-site using renewables (e.g. by installing solar panels)

- u. Procuring renewable energy off-site (e.g. via Renewable Energy Guarantees of Origin (REGO)-backed green tariffs)
- v. Increasing on-site carbon sequestration (e.g. via tree planting)
- w. Carbon offsets (e.g. via local authority Carbon Offset funds, the UK Emissions Trading Scheme or the voluntary offset market)
- 17.9.6 Following further investigation of the practicality of potential additional (secondary) mitigation measures, such as those described above, further details of those measures which will be implemented as part of the Project will be provided in the ES and within an outline Carbon and Energy Management Plan, which will be submitted as part of the DCO Application.

Enhancement measures

17.9.7 No potential enhancement measures have been identified.

17.10 Summary of residual likely significant effects

- 17.10.1 At this PEI Report stage, prior to the further development and finalisation of mitigation through the Carbon and Energy Management Plan process, the changes in carbon emissions presented in Section 17.8 are still considered to be only partially mitigated. Therefore, the impacts represent a moderate adverse effect (in accordance with the criteria set out in Table 17.5) that would fall short of fully contributing to the UK's trajectory towards net zero. In the absence of additional (secondary) mitigation measures therefore, the impact of changes in carbon emissions as a result of the Project would be significant.
- 17.10.2 As described in Section 17.9 therefore, additional (secondary) mitigation measures are being developed so that the Project's carbon impacts are consistent with applicable existing and emerging policy requirements and good practice design standards for such projects and in line with measures necessary to achieve the UK's trajectory towards net zero. Following the implementation of these additional (secondary) mitigation measures, full details of which will be presented in the ES, the residual effect of the Project on carbon emissions is expected to be of minor adverse magnitude (in accordance with the criteria set out in Table 17.5) and therefore, not significant.

17.11 Next Steps

- 17.11.1 The following next steps will be undertaken:
 - a. As the design of the Project is developed, and further information becomes available, updated and refined estimates of whole-life carbon emissions associated with the Project will be made.
 - b. These more detailed estimates will inform the identification and development of additional (secondary) mitigation measures to further reduce carbon emissions associated with the Project.
 - c. An updated assessment of the impacts of the Project will be reported in the ES, along with further details of proposed mitigation measures.

17.12 References

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