Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Sustainability Statement

Doc Ref: **7.07**

APFP Regulations 2009: Regulation **5(2)(q)**

Hard copy available in

Box **48** Folder **B**
January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Sustainability Statement

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List of abbreviations

AoS	Appraisal of Sustainability
BAP	Biodiversity Action Plan
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
C&I	Commercial and Industrial
CCS	Considerate Constructors Scheme
CDM	Construction Design and Management
CED	Construction, Excavation and Demolition
CL:AIRE	Contaminated Land: Applications in Real Environments
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CoCP	Code of Construction Practice
CR&S	Corporate Responsibility and Sustainability
CSO	Combined Sewer Overflow
Defra	Department of Environment, Food and Rural Affairs
DO	Dissolved Oxygen
DWF	Dry Weather Flow
EA	Environment Agency
EIA	Environmental Impact Assessment
EMOA	Excavated Material Options Appraisal
EqIA	Equalities Impact Assessment
FRA	Flood Risk Assessment
FSC	Forestry Stewardship Council
GGBS	Ground Granulated Blast Furnace Slag
GHG	Greenhouse Gas
GLA	Greater London Authority
GWP	Global Warming Potential
H&S	Health and Safety
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
LCC	Life Cycle Costing
LZC	Low and Zero Carbon
NPPF	National Planning Policy Framework

NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
ODP	Ozone Depleting Potential
OFWAT	Office of Water Services (UK government)
PFA	Pulverised Fuel Ash
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
PTAL	Public Transport Accessibility Level
SA/*SEA*	Sustainability Appraisal incorporating Strategic Environmental Assessment
SINC	Sites of Importance for Nature Conservation
SPG	Supplementary Planning Guidance
SPA	Special Protection Area
STW	Sewage Treatment Works
SuDS	Sustainable Drainage Systems
SWMP	Site Waste Management Plan
TBM	Tunnel Boring Machine
TUCA	Tunnelling and Underground Construction Academy
UKCP09	United Kingdom Climate Change Projections 2009
UWWTD	Urban Waste Water Treatment Directive
WFD	Water Framework Directive
WRAP	Waste & Resources Action Programme

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Main Report

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Executive summary

EX 1.1 This Sustainability Statement has been prepared to accompany the application for development consent (the 'application') for the Thames Tideway Tunnel project (the 'project').

EX 1.2 Thames Water is committed to sustainable development. This is reflected in the project's vision, which is to:

'Deliver a world class infrastructure project fit for the low carbon economy, which benefits the community, supports a healthier, cleaner River Thames and demonstrates best practice performance in sustainability across the project lifecycle'.

EX 1.3 Achieving a sustainable outcome for the project requires taking a balanced approach to social, economic and environmental objectives, whereby objectives for all three principal components of sustainable development can be successfully achieved. This *Sustainability Statement* appraises the project against 11 themes, which comprise 15 sustainability objectives. These objectives have been derived from the Government's Appraisal of Sustainability (AoS) for the Waste Water National Policy Statement (NPS); and have been adapted for the purpose of assessing the particular development for which consent is now sought.

EX 1.4 The NPS recognises (para. 2.2.1) that without suitable treatment, the wastewater that is produced everyday would damage the water environment and create severe problems for public health, water resources and wildlife. The sustainability benefits of the Thames Tideway Tunnel project are underpinned by the project's ability to improve water quality within the tidal Thames, which in turn would be an important factor in enabling London to grow and prosper in a sustainable manner. Building on the clear benefits once the tunnel is operational, Thames Water understands the importance of minimising environmental impacts from the outset of the project, whilst exploiting other opportunities available in the design and construction of the tunnel to maximise social and economic benefits.

EX 1.5 Sustainability has been a key consideration in the development of the project. This has been expressed through design development, whereby a shorter tunnel solution has been adopted, limiting the number of sites required for construction and operation, and reducing materials, energy and waste. However, the sustainability benefits of the project go far beyond this. The main appraisal findings set against the themes and objectives are shown below, demonstrating how a sustainable outcome would be achieved by the project.

Water quality: Maintain and enhance river water quality.

EX 1.6 The Thames Tideway Tunnel project would facilitate improvements to water quality of the tidal Thames. The project would secure compliance with the requirements of the Urban Waste Water Treatment Directive (UWWTD) and help to achieve compliance with the Water Framework

Directive (WFD). It would also result in the tidal Thames meeting the dissolved oxygen standards set by the *Thames Tunnel Strategic Study* and adopted by the Environment Agency (EA). It would serve to enhance water quality in the tidal Thames through the capture of approximately 96% of combined sewage and the reduction of discharges (from over 50 per year to 4 or less).

Biodiversity: Maintain and enhance biodiversity.

EX 1.7 The project has the potential to deliver significant benefits to London's wildlife. Improvements in water quality could provide conditions which are conducive to enabling a number of pollution sensitive species to recolonise the tidal Thames, providing long term legacy benefits for biodiversity. There are also opportunities to maintain and enhance permanent development sites to benefit local ecology.

Climate change mitigation: Maximise energy efficiency and minimise the carbon footprint of the project.

EX 1.8 The project would generate greenhouse gas emissions. These would arise from construction activities, and also indirectly from the production of construction materials, particularly from concrete and steel. Much of this is inevitable when creating a durable tunnel, designed to operate for at least 120 years. This *Sustainability Statement* draws from the project's *Energy and Carbon Footprint Report* to explain how emissions have been assessed and energy efficiency has been maximised to contribute to the project's sustainability.

Change adaptation and flood risk: Maximise resilience and adaptability to change, and take account of flood risk in the design of sites.

EX 1.9 The project would address the frequent discharge of combined sewage into the tidal Thames. For the project to be sustainable, it must be resilient to future change, including an increase in population and a changing climate. The system design draws from future climate change projections and population trends, and can meet these challenges with limited adaptation measures, whilst continuing to meet the project's overarching objective, to manage discharges from the most polluting CSO's.This *Sustainability Statement* also draws from the *Environmental Statement*, to demonstrate how the design of sites takes into account flood risk.

Excavated material and waste management: Minimise waste arisings and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use.

EX 1.10 Over the course of the project over 4.7 million tonnes of material would be excavated from shafts and tunnels. These materials would be managed in accordance with sustainable waste management practices, ensuring that the potential for waste is minimised as far as practical and possible, and opportunities to use it beneficially are promoted. The *excavated materials and waste strategy* (see *Environmental Statement*, Vol.3, Appendix A.3) explains how these materials would be managed in line with this objective.

Resources and raw materials: Promote the sustainable use of resources.

EX 1.11 The project would require over 1.5 million tonnes of concrete, grout and steel during construction of the tunnels and shafts. Being resource efficient is an important aim for the project, however its sustainability is dependent on its ability to be durable, and continue to function for its 120 year design life. The sustainable use of resources has been promoted through tunnel route optimisation, including the tunnel length being reduced during design development and the reduction in interception shafts required. Activities to promote the sustainable use of resources would continue through the detailed design and construction stages.

Population, human health and equality: Ensure the safety, health, and support well-being of communities in which the project operates and encourage equality and sustainable communities.

EX 1.12 The tunnel's route, covering 14 local planning authorities, passes through a diverse range of communities, including some of the most deprived areas within London. The project team has undertaken widespread consultation and engagement to ensure that communities have been consulted on the proposals. The pre application consultation exercise has ensured equality by making project information available in a wide range of formats and languages. Health benefits associated with the project would also be realised through the control of CSO discharges. This *Sustainability Statement* draws from a range of project sources, including the *Health Impact Assessment (HIA)* and *Equalities Impact* Assessment (EqIA) to examine how these objectives will be achieved.

Economy: Promote a strong and stable economy.

EX 1.13 Thames Water would implement a number of initiatives that would help maximise the economic benefits of the project. The project would support a strong and stable economy through the provision of good quality infrastructure and the creation of over 9000 jobs during the construction period. Wider benefits are expected to arise, post construction from skills development and retained infrastructure, which would leave a legacy for London's river users (commercial, community and recreation).

Environmental protection and enhancement: Minimise significant adverse environmental effects relating to air quality, odour, noise and vibration, and lighting from construction and operation of the Thames Tideway Tunnel; protect and enhance the character of landscapes and townscapes; protect and conserve the historic environment.

EX 1.14 Potential environmental effects arising from construction have been limited as far as possible through site selection and design development, albeit some effects are likely to still remain during construction and operation. The *Environmental Statement* details the assessment of the likely significant effects of the project at each site and on a project-wide basis. The effects would be minimised through the implementation of the *Code of Construction Practice (CoCP)*. Opportunities for enhancement would continue to be explored where practical and possible.

Land use: Efficient and sustainable use of land and buildings.

EX 1.15 The sites required for construction and operation of the project have been brought forward through a site selection process. This considered planning, property, environment, engineering and community aspects, as well as external consultation, resulting in the most suitable sites being selected for use. The *Final Report on Site Selection Process* explains how this has been successfully achieved. Designs have been optimised to make the most efficient and effective use of land, and re-use of buildings where practical.

Sustainable transport: Minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising the use of sustainable transport.

EX 1.16 The transportation of excavated materials, waste and construction materials would be managed to minimise impacts on communities and the environment. The *Transport Strategy* sets out Thames Water's commitment to use river transportation for the removal of excavated spoil and delivery of certain bulk materials wherever practicable, to help reduce the effects associated with road transport. This *Sustainability Statement* draws on the *Transport Strategy* to examine how the project's commitments to transport would contribute to the project's sustainability.

EX 1.17 Further details on how the project accords with the sustainability objectives, which span social, economic and environmental aspects of sustainable development are described within this *Sustainability Statement*.

1 Purpose and structure

1.1 Overview

1.1.1 London's sewer system was designed by Sir Joseph Bazalgette in the 1850s to manage wastewater and rainwater run-off through a combined collection system. This system includes relief structures known as combined sewer overflows (CSOs), designed to prevent flooding during periods of heavy rainfall by allowing the combined wastewater to flow into the tidal Thames.

1.1.2 Despite improvements over the last decade, the capacity of London's sewerage system has now been substantially exceeded. In a typical year, approximately 39 million tonnes of sewage discharges into the tidal Thames. This is largely due to the substantial increase in the population of London, rising from approximately 2.2 million in the 1850's[1] to approaching 8 million people in the 2011 census, which has resulted in an increase in water usage. In addition, greater areas of impermeable surfacing now exist, draining rainfall runoff into the combined sewers, exacerbating the impacts rainwater has within the catchment. Due to these factors, just two millimetres of rainfall can trigger a CSO discharge event.

1.1.3 These discharges give rise to a number of adverse environmental effects, including detrimental impacts on aquatic ecology, and the health and amenity of people using the river. Population trends and the increased risks posed from climate change will worsen this situation further if left unchecked. It is therefore a considerable sustainability challenge for London, which requires a clear and decisive solution.

1.1.4 The proposal is to construct a tunnel, spanning approximately 25km in length which will actively manage discharges from the 34 unsatisfactory CSOs. The project would ensure the UK complies with European environmental water quality standards and related UK regulations. This approach, supported by Mayoral and government initiatives to manage rainwater more sustainably, would assist to secure a long-term, sustainable outcome for London and the tidal Thames.

1.2 Purpose of this statement

1.2.1 The *Sustainability Statement* has been prepared to accompany of the application for the Thames Tideway Tunnel project. While there is no statutory requirement to produce this document, Thames Water regards this as best practice and the National Policy Statement (NPS) envisages that such an assessment may be appropriate (see para. 1.4.2). It is produced in accordance with the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, Regulation 5(2)(q).

1.2.2 The *Sustainability Statement* reports on the findings of a sustainability appraisal undertaken for the project, which considers how far a series of sustainability objectives, identified to be of relevance to the project, can be

met. The document takes account of the planning, regulatory and corporate drivers for sustainability that have influenced the development of the project. It draws from scheme information, including the findings of the *Environmental Statement* and other technical studies such as the *Excavated materials and waste strategy (EM&WS)(*see *Environmental Statement Vol 3 Appendix A.3), Health Impact Assessment* (*HIA*) and the *Equalities Impacts Assessment (EqIA) to* examine how the project would contribute to sustainable development.

1.3 Structure of this statement

1.3.1 The statement is structured as follows:

a. **Section 2 Policy and drivers**. This sets out the main policy and drivers for sustainable development which influence the project.

b. **Section 3 The sustainability objectives**. This explains the purpose of sustainability objectives and how these have been defined.

c. **Section 4 Appraising the project's sustainability**. This describes the methodology used to appraise the sustainability of the project and the links which exist with the Environmental Impact Assessment (EIA) process.

d. **Section 5 Development of sustainability in the project**. This explains how sustainability considerations have shaped the project.

e. **Section 6 Sustainability statement**. This provides the main findings of the sustainability appraisal. It explains how the proposals put forward in design and those that would be secured in construction and operation would contribute to a sustainable development.

f. **Section 7 Implementing sustainability**. This explains how the sustainability strategy would develop after the application is made, through further stages of the project's lifecycle.

g. **Section 8 Conclusion**. This provides a summary of the main findings of the sustainability appraisal.

h. **Appendix A Thematic sustainability appraisal**. This includes a more detailed appraisal against the sustainability objectives as well as providing further information regarding the planning policy drivers informing each sustainability objective.

i. **Appendix B Site specific sustainability appraisal**. Sustainability appraisals have been undertaken for each of the 24 development sites which consider the relationship the development proposals have with the sustainability objectives.

2 Policy and drivers

2.1 National legislation and policy

The Planning Act

2.1.1 The Government supports sustainable infrastructure and has made reforms to the planning process to ensure that it is brought forward without unnecessary delay. The Planning Act 2008 (the 2008 Act) sets out to expedite Nationally Significant Infrastructure Projects (NSIPs), which are essential to the long-term prosperity and sustainability of the country. The Thames Tideway Tunnel project falls within a new category of NSIP created by the Infrastructure Planning (Waste Water Transfer and Storage) Order 2012, made under sections 14 and 232 of the 2008 Act.

2.1.2 The 2008 Act introduces National Policy Statements, which provide the primary basis for decision making in relation to NSIPs. It is a statutory requirement under the 2008 Act, that NPS's are produced and designated with the objective to contribute to the achievement of sustainable development (NPS, para. 1.1.2).

National Policy Statement for Waste Water Infrastructure

2.1.3 The National Policy Statement for Waste Water (the NPS) was published in February 2012 by the Department for Environment, Food and Rural Affairs (Defra). It establishes the need for the Thames Tideway Tunnel project and identifies this as the preferred infrastructure solution to address the problem with CSOs. It also explains why the project is considered to be of national importance, stating in para. A1.3.6 that:

a. it is essential to meet the ecological water quality objectives of a major river of national importance;

b. it is essential to reduce the risk of human health impacts;

c. it is essential to reduce aesthetic impacts; and

d. it is essential to meet statutory requirements.

2.1.4 Sustainability is a key focus of the NPS, which recognises that waste water treatment infrastructure is essential to public health and a clean environment (para. 2.3.8). Furthermore, the NPS identifies that the demand for waste water infrastructure is likely to increase in response to some key sustainability issues (para. 2.4), including the need to adapt to climate change (para. 2.3.5). This requires additional wastewater capacity for population growth and increased urbanisation, as well as replacing ageing infrastructure (para. 2.3.11).

2.1.5 Principles of sustainable development run throughout the NPS. The Government's key policy objectives are set out in paragraph 2.3.3 of that document as:

a. Sustainable development – to seek waste water infrastructure that allows us to live within environmental limits and that helps ensure a

strong, healthy and just society, having regard to environmental, social and economic considerations.

b. Public health and environmental improvement – to continue to meet our obligations under the Urban Waste Water Treatment Directive (UWWTD) by providing suitable collection and treatment systems to limit pollution of the environment.

c. To improve water quality in the natural environment and meet our obligations under related European Directives, such as the Habitats Directive, the Water Framework Directive (WFD) and its daughter Directives.

d. To reduce water consumption by households and industry which will have the knock on effect of reducing waste water production and therefore demand for waste water treatment infrastructure.

e. To reduce demand for waste water infrastructure capacity by diverting surface water drainage away from the sewer system by using Sustainable Drainage Systems (SuDS).

f. Climate change mitigation and adaptation – in line with the objectives of Defra's mitigation and adaptation plans to help deliver the UK's obligation to reduce greenhouse gas emissions by 80% by 2050 and work to carbon budgets stemming from the Climate Change Act 2008, within the context of the EU Emissions Trading System. Also to ensure that climate change adaptation is adequately included in waste water infrastructure planning.

g. Waste hierarchy – to apply the waste hierarchy in terms of seeking to first reduce waste water production, to seek opportunities to re-use and recycle resources, and to recover energy and raw materials where possible.

Appraisal of Sustainability of the NPS for Waste Water

2.1.6 The NPS was subject to an Appraisal of Sustainability (AoS), incorporating the requirements for *Strategic Environmental Assessment* (*SEA*). The AoS has informed the preparation of the NPS, and ensures that it takes account of environmental, social and economic considerations, with the objective of contributing to the achievement of sustainable development. The AoS informed various provisions set out in the NPS, particularly factors for examination and determination of applications, and policy and guidance for the examining authority and the decision maker when considering specific impacts for the designated schemes. (para. 1.4.5).

2.1.7 The government's AoS identifies, albeit at a high level, the sustainability implications of developing a Thames Tunnel solution in London. It did this by considering how such a project would perform against sustainability objectives which span the social, economic and environmental 'pillars' of sustainable development.

2.1.8 Due to the strategic nature of the AoS, the government requires that applicants for new waste water infrastructure provide more detailed information which can be used to determine the sustainability of the proposals at the project level. (A1.3.12 of the NPS). This principally

includes the EIA, which this *Sustainability Statement* draws from. It is important to note that any sustainability appraisal undertaken for the project would not be subject to the requirements of the *SEA* Directive, which only apply to the preparation of plans and programmes in England[2].

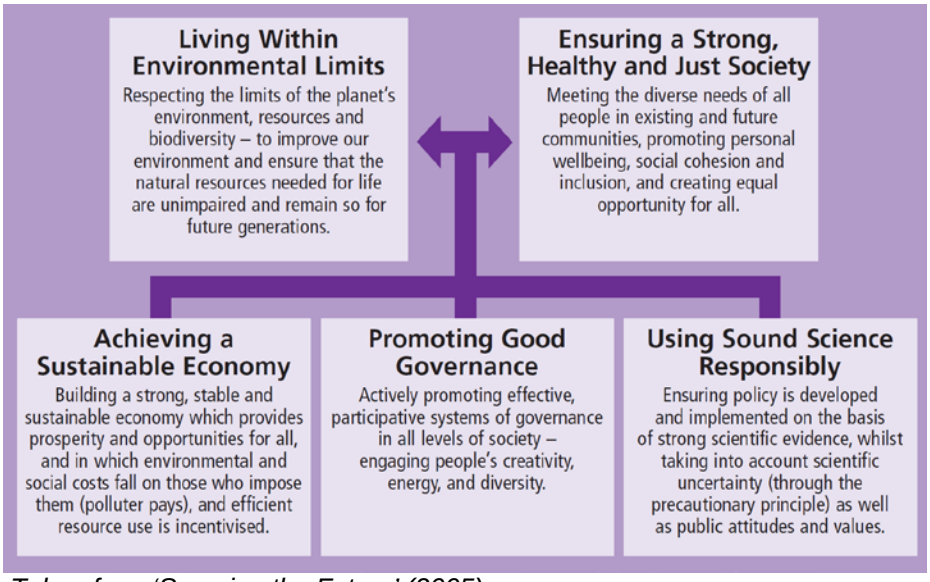
UK Sustainable Development Strategy

2.1.9 The government's *Sustainable Development Strategy* (*SDS*) 'Securing the Future' (March 2005) sets out clear guiding principles for delivering sustainable development in the UK. It states that sustainable principles:

"Will be pursued in an integrated way through a sustainable, innovative and productive economy that delivers high levels of employment; and a just society that promotes social inclusion, sustainable communities and personal well being. This will be done in ways that protect and enhance the physical and natural environment, and use resources and energy as efficiently as possible".

The guiding principles shown in Plate 2.1.1 influence policy making and the basis for sustainable development in the UK. There are two primary principles - living within environmental limits and ensuring a strong, healthy and just society, supported by three underpinning principles.

Plate 2.1.1 Five guiding principles



Taken from 'Securing the Future' (2005).

2.1.10 The four priority areas for the *SDS* are more relevant to the project than the guiding principles. These are:

a. Natural resource protection and environmental enhancement.

b. Sustainable consumption and production.

c. Climate change and energy.

d. Sustainable communities.

National Planning Policy Framework

2.1.11 Section 104 (2) of the Planning Act requires that the decision maker must have regard (amongst other matters) to any NPS that has effect, and to any other matters which the decision maker considers to be important and relevant to its decision. This may include consideration of the National Planning Policy Framework (NPPF) which was published on 27 March 2012. The NPPF now replaces the majority of the Planning Policy Guidance Notes and Statements, with the exception of a small number of documents including PPS 10 (Planning for Sustainable Waste Management).

2.1.12 The NPPF does not contain specific policies for Nationally Significant Infrastructure Projects, as these are to be found in the relevant NPSs. Paragraph 3 states: "These are determined in accordance with the decision-making framework set out in the Planning Act 2008 and relevant national policy statements for major infrastructure, as well as any other matters that are considered both important and relevant (which may include the National Planning Policy Framework). National policy statements form part of the overall framework of national planning policy, and are a material consideration in decisions on planning applications".

2.1.13 Although the NPPF does not apply directly to the project, it does provide a recent and useful summary of government policy towards infrastructure, including that for waste water. Paragraph 162 states: *"local planning authorities should work with other authorities and providers to take account of the need for strategic infrastructure including nationally significant infrastructure within their areas".*

2.1.14 The NPPF states that the purpose of the planning system is to contribute to the achievement of sustainable development (para. 6). This requires the planning system to perform economic, social and environmental roles. The economic role explicitly recognises the need for "identifying and coordinating development requirements, including the provision of infrastructure". The environmental role recognises the need to "minimise waste and pollution, and mitigate and adapt, to climate change", and the social role, which supports "strong, vibrant and healthy communities by creating a high quality built environment".

2.2 The London Plan and associated strategies

2.2.1 The *London Plan* 2011 is the development plan for the capital. Although the *London Plan* is subservient to the NPS for the purposes of decision-making under the 2008 Act, it does contain various sustainability related policies which have helped to guide the way sustainability has been integrated into the project. It also helps influence local level sustainability policies set by local planning authorities.

2.2.2 The plan as a whole sets out to embed sustainability into spatial planning, through promoting development on brownfield land, sustainable communities and encouraging sustainable transport and accessibility. The most relevant policies for sustainability in the context of design and construction are within Chapter 5 London's Response to Climate Change.

2.2.3 There are various policies in place to reduce CO_2 emissions and ensure any new development is adaptable to future climate change. Policies within the *London Plan* have been taken into account when giving consideration to sustainability options to be incorporated into the project.

2.2.4 Other Mayoral guidance has been taken into account where relevant. Key documents reviewed for this purpose include:

a. *Mayor's Climate Change Adaptation Strategy* SPG (2012).

b. *Mayor's Climate Change Mitigation and Energy Strategy* SPG (2012).

c. *Mayor's Sustainable Design and Construction* SPG (2006).

d. *Mayor's Water Strategy - Securing London's Water Future* (2011).

e. *Mayor's All London Green Grid* SPG (2012).

f. *Mayor's Waste Strategy - Making Business Sense of Waste* (2011).

g. *Mayor's Biodiversity strategy - Connecting with London's nature* (2002).

2.3 Local planning policy and guidance

2.3.1 The sustainability policies held by the 14 directly affected authorities have been considered. The following development plan documents and related sustainability guidance such as SPDs/SPGs have been reviewed for this purpose:

a. *Royal Borough of Greenwich Local Development Framework* (LDF) *Core Strategy Development Policies Document* (DPD) (Draft November 2010).

b. *Royal Greenwich Unitary Development Plan* (UDP) (adopted 2006) Policies (saved beyond July 2009).

c. *London Borough of Ealing UDP Policies (adopted* 2004).

d. *London Borough of* Ealing *Emerging Core Strategy Final Proposals DPD Policies* (adopted 2010).

e. *London Borough of Ealing Supplementary Planning Guidance* (SPG) 1 Sustainability checklist (adopted 2011).

f. *London Borough of Hammersmith and Fulham LDF Core Strategy (Proposed Submission version, October 2010) Policies*.

g. *London Borough of Hammersmith and Fulham Sustainable Construction and Recycling of Building Materials Supplementary Planning Document (SPD)* (adopted 2007).

h. *London Borough of Richmond upon Thames LDF Core Strategy* (adopted 2009).

i. *London Borough of Wandsworth adopted LDF Core Strategy* (adopted 2010).

j. *Royal Borough of Kensington and Chelsea LDF Core Strategy DPD* (adopted 2010).

k. *London Borough of Lambeth LDF Core Strategy DPD (adopted January 2011)*.

l. *City of Westminster LDF Core Strategy and DPD (adopted January 2011).*

m. *City of London LDF Core Strategy (adopted September 2011).*

n. *London Borough of Southwark LDF Core Strategy DPD* (Submission version November 2009).

o. *London Borough of Lewisham LDF Core Strategy DPD* (Proposed Submission Version February 2010).

p. *London Borough of Tower Hamlets LDF Core Strategy DPD* (adopted September 2010).

q. *London Borough of Newham LDF Core Strategy* (2012).

2.3.2 Further details relating to the relevant planning policy is available within the *Planning Statement*. Planning policies which specifically inform the project's sustainability objectives are described within Appendix A.

2.4 Thames Water and sustainable development

2.4.1 There are many definitions of sustainability. For Thames Water, it means that future generations should not be disadvantaged by the actions that its business decides to take today.

2.4.2 *"Sustainability is about planning and operating in a socially, environmentally and economically responsible way. It ensures it is able to deliver the same or improved levels of service into the future, whilst also protecting the environment, operating responsibly within the communities it serves, and providing effective stewardship of its assets"*[3]*.*

2.4.3 Thames Water has embraced the concept of sustainable development and is integrating corporate responsibility measures across its business practices. Its approach to sustainability has been captured in the '*Thames Water Annual Performance Report'* (2011/2012), which states:

"To ensure that we provide a service on which future generations can rely, we need to strike a balance between the level of service we provide, our impact on the environment, and the level of customer bills. Future plans are informed by nine sustainability themes:

a. ***Precious Water*** *– driving down demand;*

b. ***Sustainable drainage*** *– preventing sewer flooding and pollution;*

c. ***Efficient operations*** *– reducing the use of natural resources, minimising waste, and sustainable sourcing;*

d. ***Responsible operations*** *– investing in communities and being good neighbours;*

e. ***Climate change mitigation*** *– minimising our carbon footprint;*

f. ***Climate change adaptation*** *– future resilience;*

g. ***Customer inclusion*** *– access to services, fair charges and active engagement;*

h. ***Sustainable workforce*** *- employment and employability; and*

i. ***Sustainable investment*** *– taking the longer-term view and managing the financeability of our business".*

2.4.4 Further details on its corporate responsibility and sustainability (CR&S) strategy and how it is working towards this is available in its *Corporate Responsibility Report*: http://www.thameswater.co.uk/cr/.

2.4.5 To reflect the importance that national policy places on sustainable development, Thames Water has developed the following sustainability vision for the Thames Tideway Tunnel project. This captures the intent to advance the project with due regard for sustainability and to:

"Deliver a world class infrastructure project fit for the low carbon economy, which benefits the community, supports a healthier, cleaner River Thames and demonstrates best practice performance in sustainability across the project lifecycle".

2.4.6 The following section identifies how Thames Water has defined sustainability objectives to help deliver this vision.

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3 The sustainability objectives

3.1 Overview

3.1.1 Thames Water has developed a series of sustainability objectives for the project, ordered into thematic areas. These ensure that consideration is given to promoting better social, economic and environmental outcomes. This section explains:

a. the purpose of the sustainability objectives;

b. the process that has been undertaken to identify relevant sustainability objectives;

c. how the objectives selected correspond to those applied by the government during its AoS of the NPS for Waste Water; and

d. the sustainability themes and objectives applied.

3.2 The purpose of the objectives

3.2.1 Whilst not directly applicable to the project, the Government's Practical Guide to the Strategic Environmental Assessment Directive[4] provides a helpful definition of a sustainability objective, as:

"A statement of what is intended, specifying a desired direction of change" [5]

3.2.2 With the above definition as context, the sustainability objectives for the Thames Tideway Tunnel project have been defined for two purposes.

a. firstly, they will guide the project's approach to sustainability, and would continue to be relevant during the further stages of the project to plan and develop sustainability initiatives. The role the sustainability objectives will have with ongoing strategy development is explained in Section 7.

b. secondly, and most relevant to this *Sustainability Statement*, is their application to appraise the sustainability of the project. The application of the objectives within the sustainability appraisal is explained within the next section (Section 3).

3.3 Process for defining sustainability objectives

3.3.1 The principal factors informing the sustainability objectives applied to the project include:

a. the need for them to represent relevant sustainability issues for an NSIP for waste water;

b. the need for them to align with relevant planning policy; and

c. the need to align with Thames Water's CR&S aspirations.

3.3.2 During the development of the sustainability objectives, two approaches were considered:

a. the use of existing themes and objectives, applied for the government's AoS for the NPS for Waste Water (AoS); and

b. the development of a bespoke framework, which departs from the government's themes and objectives, yet still aligns with policy and regulation.

3.3.3 Project workshops were held to explore the relative benefits and drawbacks for applying each approach. It was decided that the sustainability objectives should be closely informed by those applied in the government's AoS, however should be modified to reflect the sustainability priorities of Thames Water, and to address local policies relevant to London.

3.3.4 The alignment of the themes and objectives for the project with those already applied by government was considered to be beneficial, for the following reasons:

a. the themes and objectives outlined in the AoS have already been subject to a scoping exercise by the Government, and have been found to be relevant to the development of NSIPs relating to Waste Water.

b. a project level appraisal, applying broadly the same objectives, provides further detail on how sustainability objectives relevant to the project can be met. Such an approach would be useful to support the planning process.

3.3.5 The workshops also revealed drawbacks for applying the same set of objectives applied in the AoS, principally:

a. with the benefit of more detailed project information available, the themes and objectives applied by the AoS were not considered to be an exact fit with the project. More specific objectives could be tailored which better reflect the project, particularly to address the CR&S aspirations of Thames Water.

b. the application of certain AoS themes and objectives would lead to duplication between EIA topic areas and what is appraised and presented in the *Sustainability Statement*. A shorter, more focused set of themes and objectives was thought desirable.

c. adaptation of the government's appraisal objectives would enable them to reflect more closely the priorities emerging within the *London Plan 2011* for sustainable development.

3.3.6 A gap analysis was undertaken to identify how the government's AoS could be adapted to better fit the project appraisal. The main findings of which are shown in Table 3.3.1 below.

Table 3.3.1 Main findings of a gap analysis exploring the suitability of the government's AoS objectives.

AoS of the NPS for Waste Water		Issues and reasoning
Theme	**Objective**	
Climate Change and Adaptation	To minimise detrimental effects on the climate from greenhouse gases and maximise resilience and adaptability to climate change	There is a strong emphasis on climate change mitigation and adaptation in the *London Plan 2011* and from Thames Water. The AoS objective should be split, to ensure greater clarity between the two parts of the government's objective. This is particularly as the design response to address these issues is quite different. The objective should also take account of population change, which is a major driver for the project and influences design.
Biodiversity	To maintain and enhance biodiversity	Biodiversity conservation and enhancement are both important aspects of policy. These are covered within the AoS objective and no modifications are proposed.
Land Use	To contribute to a more sustainable pattern of land use	The thematic area of land use is important and relevant to sustainable development of the project. The project focus has been on the efficient and sustainable use of land. The *London Plan 2011* also promotes the efficient use of buildings, which should be addressed. A modification is proposed to reflect the importance of sustainable use of land and efficient use of buildings.
Water Quality and Resources	To maintain and enhance water resources and quality	Water quality and water (as a resource) are both important issues for the project and to Thames Water, and accordingly should be split as the design response is different. The emphasis for water quality should be on river water quality (a main driver for the project), therefore particular focus should be given to that issue. Ground water should be considered in the appraisal, when developing appraisal guide questions. Water as a resource (ie, water consumption) should move to a general resource

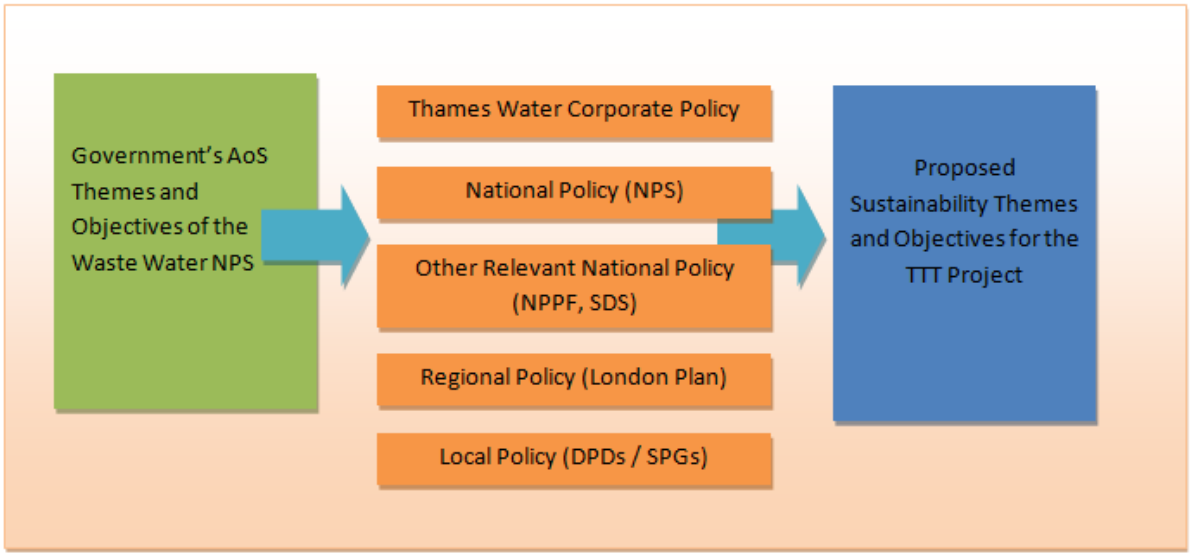
AoS of the NPS for Waste Water		Issues and reasoning
Theme	**Objective**	
		use theme.
Waste Management	To minimise waste arisings, promote re-use, recovery and recycling and minimise the impact of waste on the environment and communities	The objective is appropriate as it reflects policy; however the thematic area should be re-named to reflect that excavated material is the most significant issue. The objective should be tailored further to emphasise the importance of beneficial use activities for excavated material, this should be included within the hierarchy.
Resources and raw materials	To promote the sustainable use of resources and natural assets and to deliver secure, clean and affordable energy	The AoS objective includes reference to clean and affordable energy. It is considered that this is better handled under a theme relating to climate change mitigation, and not resources. The objective should be simplified to promote sustainable use of resources in general, which can pick up issues such as materials and water.
Population and human health	To protect and enhance the physical and mental health of the population	Thames Water is committed to health and safety, and whilst the principle of this objective is appropriate, emphasis should be given to health and safety, and well being of the population associated with the construction and operation of the project. Mental health matters have been included under the broader heading of general well-being.
Equality	To encourage equality and sustainable communities	The objective is relevant in policy and to Thames Water's CR&S aspirations. This objective should be linked under a shared thematic area with population and human health.
Economy	To promote a strong and stable economy	This objective is supported by policy and aligns with Thames Water's CR&S aspirations. No alterations have been made.
Air quality	To maintain and improve air quality	The topic of air quality is important for the project, particularly in terms of nuisance and odour; however the objective to improve air quality is not practical. To avoid duplication with

AoS of the NPS for Waste Water		Issues and reasoning
Theme	**Objective**	
		the EIA, focus should be given to consolidating environmental related topics into a single objective, and reported under a joint environmental protection theme.
Landscape, townscape and visual	To protect and enhance the character of landscapes and townscapes	The objective is appropriate; consideration should been given to consolidating the objective into a joint environmental theme.
Archaeology and cultural heritage	To protect and conserve archaeology and cultural heritage	The objective is appropriate; consideration should been given to consolidating the objective into a joint environmental theme.
Soil and geology	To conserve and enhance soil and geology	Whilst the objective is appropriate in policy terms, the project would affect very limited soil, and geology would be inevitably affected. The ability to enhance geology is not practical. This objective should be removed; however consideration should be given to this in the appraisal using guide questions under the sustainable use of land theme.
Noise	To minimise the effects of noise, particularly where it will impact on human health	The topic of noise for the project is important, particularly in terms of disturbance to local receptors around construction sites. Focus should be given to consolidating environmental related topics into a single objective and reported under a joint environmental protection theme.
Traffic and transport	To minimise the detrimental impacts of travel and transportation on communities and the environment, whilst maximising positive effects	This is a relevant objective, although could be tailored more closely to the project to address the transportation of construction materials and waste. Given the level of influence the project holds, reference should be given to prioritising sustainable transport, which is an important focus of planning policy rather than maximising positive effects from transport.
Flood risk	To avoid an increase in flood risk and to	This objective should be modified to reflect that it is not possible to avoid

AoS of the NPS for Waste Water		Issues and reasoning
Theme	**Objective**	
	avoid siting flood sensitive infrastructure in areas of high flood risk	siting infrastructure in high flood risk areas. Emphasis of the objective should be on how flood risk has been taken into account in design. It should also be linked with the thematic area relating to climate change adaptation.
Coastal change	To minimise coastal flood and erosion risk	This objective is not relevant for the project. This spatial scope of the EIA does not take into account coastal processes. Erosion risks from scour are addressed in the *Environmental Statement*, specifically in water quality, aquatic ecology and historic environment.

3.3.7 The development of the sustainability themes and objectives is shown diagrammatically in Plate 3.3.1 below. As identified above, the government's sustainability objectives within its AoS provide a sound starting point on which to base the project level sustainability appraisal. This is because they reflect the sustainability priorities of a NSIP for waste water. During the process for refining the objectives, Thames Water's CR&S aspirations have been taken into account. Consideration has also been given to aligning the objectives with other national, regional and local policy. The themes and objectives have been developed with due regard to sustainability policy, and with specific attention paid to the NPS for Waste Water. The main policies and drivers informing each objective are provided in Appendix A.

Plate 3.3.1 Sustainability framework development



3.4 The sustainability objectives applied

3.4.1 Based on the above, the following sustainability themes and objectives, shown in Table 3.4.1, have been applied to the project.

Table 3.4.1 The sustainability themes and objectives applied to the project

Theme	Objective
Water Quality	Maintain and enhance river water quality
Biodiversity	Maintain and enhance biodiversity
Climate change mitigation	Maximise energy efficiency and minimise the carbon footprint of the project
Change adaptation and flood risk	Maximise resilience and adaptability to change
	Take account of flood risk in the design of sites
Excavated material and waste management	Minimise waste arisings and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use
Resources and raw materials	Promote the sustainable use of resources
Population, human health and equality	Ensure the safety and health, and support well-being of the communities in which the project operates
	Encourage equality and sustainable communities
Economy	Promote a strong and stable economy
Environmental protection	Minimise significant adverse environmental effects relating to air quality, odour, noise & vibration and lighting from construction and operation of the Thames Tideway Tunnel project
	Protect and enhance the character of landscapes and townscapes
	Protect and conserve the historic environment
Land use	Promote the efficient and sustainable use of land and buildings
Sustainable transport	Minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising the use of sustainable transport

3.4.2 The following section explains how these objectives have been used to appraise the project.

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4 Appraising the project's sustainability

4.1 Overview

4.1.1 Undertaking a sustainability appraisal to support the application for development consent for the project is not a statutory requirement under the 2008 Act; however Thames Water regards this as best practice.

4.1.2 The *Sustainability Statement* does not set out to appraise the sustainability of the project against other strategic alternatives. This has already been examined by the government as part of the process of preparing the NPS.

4.1.3 The appraisal undertaken for the project examines how the particular scheme for which development consent is sought supports sustainable development, and to what extent sustainability objectives, themselves informed by policy, have been achieved.

4.1.4 The sustainability objectives applied for this purpose have been introduced in the previous section. This section explains:

a. The methodology applied to undertake the sustainability appraisal and how this compares to the government's AoS.

b. The sustainability appraisal guide questions and how these have been defined and applied.

c. The main information sources used to undertake the appraisal.

d. The links between the sustainability appraisal applied for the project and the EIA process.

4.2 Appraising sustainability

4.2.1 The government's AoS of the NPS for Waste Water was undertaken in accordance with the European Strategic Environmental Assessment (*SEA*) Directive (2001/42/EC)[6], which is a requirement for the preparation of plans and programmes in England. The AoS follows a prescribed approach, and has been developed through a series of stages in accordance with best practice guidance (ODPM, 2006)[7].

4.2.2 The government's AoS considered to what extent sustainability objectives had been achieved by applying a scoring criteria system, whereby the objectives were judged to have been met, not met, or uncertain (in cases where insufficient information was available). Performance of the NPS against the objectives was appraised using a matrix based scoring system, and draws from a series of guide questions to inform judgement.

4.2.3 The extent to which an objective is met is also assessed based on its significance criteria, and considers this relationship over the short, medium and long-term. The AoS also considers secondary, cumulative and synergistic effects in accordance with the provisions of the *SEA* Directive.

4.2.4 The sustainability appraisal that has been undertaken for the project attempts to align, as far as practical, to the government's AoS, particularly in aligning to the themes and objectives relevant to an NSIP for Waste

Water. The approach taken does not aim to replicate the Government's assessment in its entirety. A principal difference is the project level appraisal undertaken moves away from the matrix based appraisal criteria, towards a more qualitative analysis of how objectives would be achieved. The appraisal reported within this *Sustainability Statement* therefore adopts a simplified system. It focuses more closely on providing commentary, rather than the application of scores against individual matrices.

4.2.5 There is a greater level of flexibility in the way that such appraisals can be undertaken for 'projects', as opposed to policies and plans, as 'projects' do not fall within the scope of the *SEA* Directive. Given this flexibility, the decision to adopt a narrative based appraisal, as opposed to a matrix based appraisal has been taken for the following reasons:

a. The application of appraisal matrices requires that significance is assessed, which is a key part of the AoS and the assessment of affects. For the project level appraisal, the *EIA* already assesses the significance of environmental effects for the project, and the sustainability appraisal draws on this. It is not appropriate to develop an alternative process for assessing significance for the sustainability appraisal, which may lead to confusion through contradictions or inconsistencies.

b. Assessing the performance against scoring criteria is inherently problematic, as performance may vary depending on whether the appraiser is considering the project as a whole, or specific relationships for each worksite. Applying a narrative based approach helps to explain this relationship.

c. The application of scoring matrices is inherently subjective. Applying a simple narrative based approach, drawing from appraisal guide questions, can help to limit subjectivity.

Developing guide questions

4.2.6 The appraisal is informed by a series of guide questions which help to consider the relationship between the project and the sustainability objectives. These questions have been developed with reference to the government's AoS, and have been added to, or modified where necessary, to enable a more complete appraisal of the project's sustainability performance. The guide questions have been the subject of a dedicated workshop where the applicability of each was assessed. These have also been considered in further detail through a programme of sustainability working group sessions, which have been used to evaluate the suitability of guide questions in the context of each objective.

4.2.7 The project-wide sustainability appraisal made against the guide questions is presented within Appendix A. The guide questions applied are set out below in Table 4.2.1.

Table 4.2.1 Sustainability appraisal guide questions

Water Quality	
Objective	Maintain and enhance river water quality
Guide questions	• Will the project protect surface and groundwater quality? • Will the Thames Tideway Tunnel project prevent deterioration of and enhance water quality in the River Thames and Thames Estuary through point source pollution? • Will the Thames Tideway Tunnel project help to achieve Good Ecological Potential in the Thames Estuary by 2027?
Biodiversity	
Objective	Maintain and enhance biodiversity
Guide questions	• Will priority habitats and species, and sites designated for their nature conservation value, including the Lee Valley SPA and Thames Estuary and Marshes SPA & Ramsar site, be protected and enhanced? • Will the project result in no net loss of wildlife sites in London in accordance with the *Mayor's Biodiversity Strategy*? • Will the project contribute to the protection, promotion and management of aquatic ecology? • Will the project contribute to the protection, promotion and management of terrestrial ecology?
Climate change mitigation	
Objective	Maximise energy efficiency and minimise the carbon footprint of the project
Guide questions	• Has the Thames Tideway Tunnel project been designed to be energy efficient? • Has Thames Water assessed energy, carbon dioxide and other greenhouse gases? • Has Thames Water considered lower carbon solutions? • Will the Thames Tideway Tunnel project make use of, and contribute to, the production of renewable energy? • Will the Thames Tideway Tunnel project increase emissions of carbon dioxide and other greenhouse gases?
Change adaptation and flood risk	
Objective	Maximise resilience and adaptability to change
Guide questions	• Will the Thames Tideway Tunnel project increase London's resilience and adaptability to the effects of population change? • Have the future effects from climate change been taken into account? • Will the Thames Tideway Tunnel project ensure continuity of collection and treatment of waste water during a typical year up to

	2080? • Has Thames Water considered the effect of temperature change (e.g. the urban heat island effect)?
Objective	Take account of flood risk in the design of sites
Guide questions	• Will development associated with the Thames Tideway Tunnel project occur in areas at risk of flooding? • Will the Thames Tideway Tunnel project affect flood risk elsewhere in London? • Will the Thames Tideway Tunnel project alleviate potential flood risk? • Will the project contribute to the sustainable management of surface water drainage in London?
Excavated material and waste management	
Objective	Minimise waste arisings and its impacts on the environment and communities and to drive re-use, recovery, recycling and beneficial use
Guide questions	• Will the project encourage the management of construction, demolition and excavation waste in line with the waste hierarchy (which is prevention, preparing for re-use, recycle, other recovery, and disposal) in accordance with the Waste Framework Directive? • Will the project affect existing waste management capacity? • Has Thames Water considered environmental and amenity impacts from excavated material and waste on communities?
Resources and raw materials	
Objective	Promote the sustainable use of resources
Guide questions	• Will the recovery of raw materials be encouraged during the construction and operation of the Thames Tideway Tunnel project? • Will the efficient use of sustainable raw materials be promoted during construction of the Thames Tideway Tunnel project? • Will the project minimise the demand for non-renewable resources? • Has Thames Water considered the impacts on the availability of water resources? • Has Thames Water considered opportunities for effective water usage?
Population, human health and equality	
Objective	Ensure the safety and health, and support well-being of the communities in which the project operates
Guide questions	• Will the project affect the health or well-being of the population in those boroughs through which the Thames Tideway Tunnel

	passes? • Has the project minimised potential nuisance to local communities?
Objective	Encourage equality and sustainable communities
Guide questions	• Will the project result in changes to community services or facilities? • Will the project adversely affect the more disadvantaged sections of society?
Economy	
Objective	Promote a strong and stable economy
Guide questions	• Will the Thames Tideway Tunnel project create local employment and skills development opportunities? • Will the project help to ensure long-term investment in London and promote sustainable growth in the regional economy?
Environmental protection	
Objective	Minimise nuisance and significant adverse effects relating to air quality, odour noise & vibration and lighting from construction and operation of the Thames Tideway Tunnel project
Guide question	• Will the project result in the worsening of air quality in existing areas of poor air quality (e.g. AQMAs)? • Will the project cause a worsening in odour? • Will the project lead to increased levels of noise and vibration at sensitive receptors (e.g. housing, schools and hospitals)? • Will the project lighting cause nuisance at local receptors?
Objective	Protect and enhance the character of landscapes and townscapes
Guide question	• Will the project result in adverse effects on locally valued landscapes or townscapes? • Will the project affect the tranquillity of London's open spaces, green networks and public realm?
Objective	Protect and conserve the historic environment
Guide questions	• Will London's historic environment be protected and conserved in a manner appropriate and proportionate to its significance during the construction and operation of the Thames Tideway Tunnel project?
Land use	
Objective	Efficient and sustainable use of land and buildings
Guide questions	• Has the route of the tunnel had an adverse effect on open spaces, green spaces or sports and recreation land? • Has the choice of sites for the project prioritised the use of previously developed land?

	• Will the project maximise the efficient use of land and buildings?
Sustainable transport	
Objective	Minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising the use of sustainable transport
Guide questions	• Will the project affect local transport networks and manage the associated impacts on local communities? • Will Thames Water prioritise sustainable transport modes for moving materials to and from site? • Will Thames Water prioritise sustainable transport modes for workers accessing sites? • Will the project minimise marine navigation impacts?

Appraising sustainability at different phases of the project's lifecycle

4.2.8 The performance against sustainability objectives may vary considerably depending on which phase of the project's lifecycle is under consideration. The construction phase would last up to six years in duration, while the operation of the tunnel would be for a minimum of 120 years, with no decommissioning anticipated. The relationship with the objectives during the construction and operational phases is often very different. The appraisal undertaken for the project accounts for this, explaining the varying performance where this arises.

4.2.9 For the purposes of this appraisal, short-term effects relate to the construction phase. Medium to long-term effects relate to the operation of the tunnel.

Project-wide and site-specific sustainability appraisals

4.2.10 In addition to timescale, the implication of geographical scale also has a major bearing on the sustainability appraisal. The appraisal is set at a level which considers the relationship with the objectives across the project as a whole, rather than on a site-specific basis. This reflects that the project is nationally significant, and that the sustainability performance cannot be judged in isolation, but more appropriately, should be viewed across the whole project. The project wide sustainability appraisal is found in Appendix A.

4.2.11 Notwithstanding that the sustainability of the project is best judged across the project as a whole, sustainability appraisals have been undertaken for each site, to consider the general relationships between the objectives at the site-level. This has been an important part of identifying opportunities for enhancing sustainability at the site level. The findings of the site-specific sustainability appraisals are provided in Appendix B.

4.3 Evidence base and information sources

4.3.1 To inform the appraisal, a number of technical studies and strategies were reviewed and taken into account when appraising performance against the sustainability objectives. Table 4.3.1 identifies the range of technical studies which have been prepared by Thames Water for the application and which have been drawn upon for the appraisals.

Table 4.3.1 Information sources for the sustainability appraisal

Source	Description
Environmental Statement	This identifies the environmental baseline and assesses the environmental impacts, having regard to proposed mitigation measures of the proposed development.
Code of Construction Practice	This sets out the arrangements for the management and construction of the project to minimise / reduce any significant effects of construction.
Resilience to Change Report	This report addresses the future conditions that evidence from climate modelling and demographic projections suggests the Thames Tideway Tunnel project will be subject to during the 21st Century.
Health Impact Assessment	This identifies and assesses the potential health outcomes (both adverse and beneficial) of the project.
Final Report on Site Selection process	This explains the approach taken in identifying the sites required to construct and operate the project. It describes how the approach has taken account of consultation comments.
Transport Assessment	This provides an assessment of the impacts of the Thames Tideway Tunnel project. It identifies the proposed strategy for moving construction materials and excavated waste materials for the project, as well as construction workers. A draft *Project Framework Travel Plan* (*PFTP*) is appended to the *Transport Assessment*.
Waste Management Strategy, Excavated Material and Waste Strategy and Excavated Material Options Appraisal appended to Volume 3 of the ES.	There are a collection of relevant waste strategy documents. These set out the project's approach to waste management, including the way in which the Waste Hierarchy would be promoted. This includes an *Excavated materials options appraisal*, which considers the preferred options for the disposal of excavated material.
Energy and Carbon	An assessment has been made of the energy

Source	Description
Footprint Report	and carbon embedded in the construction and operation of the project. The report identifies the benefits (expressed in carbon terms) for some of the initiatives proposed for the project, for example the transport strategy. It also sets out where efforts for managing CO_2 in further design and construction will be focused.
Equalities Impact Assessment	An *Equalities Impact Assessment* (*EqIA*) has been prepared to ensure that the project does not discriminate against any individual or community and, where possible, to promote equality for all, in accordance with the requirements of the NPS for Waste Water.
Consultation Report	A consultation report has been produced for the project. The report examines how the project has taken account of a range of feedback from stakeholders.
Design and Access Statement	*Design and Access Statements* have been prepared for the NSIP to identify the design rationale for the development. A Project-wide *Design and Access Statement* provides overarching information on the project, and establishes sustainability principles relevant to the project as a whole. The *Design and Access Statement* includes the design principles which have been applied at development sites.
Design principles	These describe the design principles that underpin the design of the above-ground elements and spaces of the project. They apply to the permanent operation phase of the project, but not to the temporary construction phase.

4.4 Links with the Environmental Impact Assessment process

4.4.1 One of the primary sources of evidence for the sustainability appraisal has been the extensive work that has been undertaken through the Environmental Impact Assessment (EIA) process.

4.4.2 The Department of Communities and Local Government (DCLG) defines EIA as *"the process for identifying the environmental effects (positive and negative) of proposed developments before development consent is granted. The aim of EIA is to document, prevent, reduce or offset the significant adverse environmental effects of development proposals, whilst enhancing positive effects. It is a means to ensure that planning decisions are made in the knowledge of the environmental effects, and with full*

engagement of statutory bodies, local and national groups, and members of the public" (Department of Communities and Local Government, 2006)[8].

4.4.3 The EIA process therefore makes an important contribution to the promotion of sustainability of the project. The process enables the identification of likely significant effects and mitigation, thus promoting environmental protection and enhancement.

4.4.4 Many of the sustainability objectives applied to the project relate to matters that are addressed within the *Environmental Statement*. The sustainability appraisal does not set out to replicate the *Environmental Statement*, however draws from its findings to assess how far certain sustainability objectives have been achieved. This *Sustainability Statement* draws in particular, from the significance of environmental effects in construction and operation.

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5 The development of sustainability for the Thames Tideway Tunnel project

5.1 Context

5.1.1 The NPS recognises that without suitable treatment, the wastewater that is produced everyday would damage the water environment and create severe problems for public health, water resources and wildlife. The sustainability benefits of the Thames Tideway Tunnel project are underpinned by the project's ability to improve water quality within the tidal Thames, which in turn would be an important factor in enabling London to grow and prosper. These considerations are explained within the next part of this document, and are material when considering the overall sustainability of the project.

5.1.2 Thames Water is committed to sustainable development. Building on the clear benefits once the tunnel is operational, it understands the importance of minimising environmental impacts from the outset of the project, while exploiting other opportunities available in the design and construction of the tunnel. Sustainability has been a key consideration in the development of the project, which can be tracked through various decisions made and activities undertaken.

5.1.3 This section explains how activities taken through project planning contribute to sustainable development. Section 7 goes on to explain how sustainability would continue to be an important aspect of the project in future design and construction stages. Specifically, this section:

a. Provides an explanation of how the development of strategic options has contributed to the project's sustainability, through the selection of an economic and efficient solution.

b. Describes how the site selection process and consultation exercises have helped to shape the sustainability of the project, ensuring environmental effects are avoided where possible and social inclusion is promoted.

c. Explains how design development has taken account of sustainability.

d. Provides a summary of the development proposals put forward as part of the application.

5.2 Development of project options

5.2.1 The Thames Tideway Strategic Study (TTSS) investigated the environmental impact of wet weather discharges from 57 CSOs across the tidal Thames. As part of the study, the EA evaluated the volume and frequency of the discharges from these CSOs, as well as assessing their impact on river water quality and ecology. These were then categorised and a total of 36 CSOs were identified as being unsatisfactory and therefore requiring control. Of these, 34 discharge directly into the tidal River Thames and the other two into the tidal River Lee. The remaining 21

CSOs were assessed by the EA as not requiring any action to be taken. The study also took account of the cost and benefits of a number of solutions to the problems, and concluded that a storage and transfer tunnel was the preferred solution for addressing the CSO problems within the tidal Thames[9]. A further independent review through Defra's Regulatory Impact Assessment[10] supports the tunnel solution. Information on this process is documented in the *Thames Tideway Strategic Study*[11] and explained within the *Needs report.*

5.2.2 Three route options were initially considered: the Thames Route, The Rotherhithe Route, and the Abbey Mills Route. The Abbey Mills Route is shorter that the River Thames and Rotherhithe routes, by 9km and 6.7km respectively. It has been favoured because it provides the most efficient and economic solution to addressing the 34 unsatisfactory CSOs which discharge directly into the Thames.

5.2.3 Through CSO control studies and design development, 14 of the unsatisfactory CSOs have been identified as being able to be controlled indirectly. This reduces the number of worksites that would be required, where direct interception is replaced by efficient use of the existing sewerage systems.

5.2.4 Through adopting the shorter tunnel route, and consolidating the number of construction sites required, the following factors are limited: the use of natural resources; energy during construction; environmental harm and nuisance; waste and excavated material generation. The proposal to adopt this route therefore has a number of sustainability benefits, which are discussed within this document.

5.3 Site selection process

5.3.1 Whilst the large majority of the tunnelling works would be situated underground, there would be requirements for temporary land take during the construction of the tunnel, and to a much lesser extent, permanent land take for maintenance access and operational structures.

5.3.2 Through design development, the amount of land required for the project sites has been limited as far as possible to ensure land is used efficiently and with a view to minimising the use of Greenfield sites.

5.3.3 From the outset, the process of site selection has been structured in a way which ensures a transparent and even-handed approach is taken to the choice of sites brought forward. Thames Water has applied expertise from five interlinked disciplines; planning, property, environment, engineering and community. The expertise in each area and coordination of this has promoted a balanced approach to project choices and decisions taken towards site selection. This approach has enabled many potential local impacts to be avoided altogether. The importance of this process to deliver a sustainable development is explored throughout this *Sustainability Statement*.

5.4 Environmental design

5.4.1 Closely linked to site selection has been the process of environmental design. As an overarching principle Thames Water has actively sought to prevent, reduce and offset adverse environmental effects, and consider opportunities for beneficial effects. This has been done through the design and assessment process and would continue through the environmental management process (*Construction Environmental Management Plans*), should development consent be granted.

5.4.2 The design process has followed an iterative approach, and has taken account of the views of external stakeholders, and the inputs of various technical teams. As part of this, environmental design solutions have been embedded in the scheme to limit effects and promote positive outcomes. These have been identified through the EIA process and form part of the mitigation for the sites.

5.4.3 The EIA has involved a collaborative and partly sequential, partly iterative approach to identifying impacts and effects and determining appropriate design measures and mitigation. For example, the effects of air quality upon residential receptors have been identified by air quality specialists as a result of proposed demolition and construction activities. These impacts and effects, in particular where significant, have then been regularly communicated to the project team for attention, principally through regular design workshops, alongside suggested measures to prevent, reduce and offset them.

5.4.4 As part of this process, opportunities for legacy have been considered and built-in, particularly where mutually beneficial effects exist with surrounding developments. In pursuit of a sustainable legacy for the project, a series of design principles have been established to help ensure that the legacy benefits of permanent development is maximised. The design principles underpin the design of the permanent above-ground elements and spaces associated with the project which are described in more detail in the *Design and Access Statement*.

5.4.5 A number of the design principles help to deliver the sustainability objectives for the project. These are identified throughout this *Sustainability Statement*.

5.5 Consultation process

5.5.1 Thames Water recognises that effective consultation is an important element of project planning, and necessary to deliver a sustainable outcome.

5.5.2 Thames Water has undertaken extensive consultation with statutory consultees, local authorities, landowners and community consultees (including the general public) and other interested parties. The site selection process, alongside many other elements of the project, has been advanced through this robust consultation exercise.

5.5.3 The process has involved formal consultation events, alongside a thorough programme of continued engagement with a large number of stakeholder groups. Further details of this are reported within the *Consultation report*.

5.5.4 The pre-application consultation process carried out in relation to the project has; complied with relevant legal requirements, has taken account of published guidance and has exceeded best practice both in terms of its inclusivity and approach. It included:

a. separate consultation and engagement phases (phase one, interim engagement and phase two, plus targeted consultation) and statutory publicity of the proposed application

b. 135 advertised exhibitions, attended by over 8,000 people

c. attendance by Thames Water at over 100 meetings at the request of community groups

d. over 2,500 customer calls taken by a dedicated communications team, through a free to call helpline

e. media made available in a number of formats, languages, large print and in Braille

f. an accessible website with detailed project information and links.

5.5.5 A range of information on the project has been consulted on, including:

a. the need for the project, including whether a tunnel is the most appropriate solution and alternatives

b. the preferred tunnel route, including the detailed alignment of the tunnel

c. the preferred sites for the construction and permanent works

d. the detailed proposals for the preferred sites, which take into account the results of our phase one consultation and further, more detailed, technical work undertaken

e. the preliminary findings of the assessment of effects of the project, as reported in the preliminary environmental information report (PEIR).

5.5.6 Where appropriate, design development has reflected the feedback received, as demonstrated by the following:

a. increased use of the river for transporting excavated material away from sites as opposed to by road

b. access routes modified to take into account local concerns

c. worksite sizes optimised to minimise impact.

5.5.7 Further information about how each site has developed in response to consultation, is available within the *Design and Access Statement, the Consultation Report and the Final Report on Site Selection Process.*

5.6 The proposed development

5.6.1 The project consists of a wastewater storage and transfer tunnel (the 'main tunnel') between the Thames Water operational sites at Acton Storm Tanks and Abbey Mills Pumping Station.

5.6.2 The project comprises two main elements:

a. tunnels:

   i the main tunnel
   ii connection tunnels.

b. sites:

   i main tunnel sites
   ii CSO sites
   iii system modification sites
   iv Beckton Sewage Treatment Works.

Tunnels

Main tunnel

5.6.3 The horizontal alignment of the main tunnel would generally follow the River Thames, where possible and practical, in order to:

a. ensure the most efficient route to connect the CSOs located on both banks of the river

b. enable river transport during construction to supply and remove materials, where practicable and economic

c. minimise the number of structures the tunnel would pass beneath in order to reduce the number of third parties affected.

5.6.4 The main tunnel route would take the shortest line from Acton Storm Tanks to the River Thames and stay beneath the river from west London to Rotherhithe. It would then divert from beneath the River Thames to the northeast via the Limehouse Cut and terminate at Abbey Mills Pumping Station, where it would connect to the Lee Tunnel.

5.6.5 The main tunnel would be approximately 25km long with an internal diameter of 6.5m in the west increasing to 7.2m through central and east London. The approximate depth of the tunnel would be between 30m in west London and 65m in the east in order to provide sufficient clearance to existing tunnels and facilities under the capital.

5.6.6 At main tunnel sites, shafts would be excavated to the appropriate depth. The tunnel boring machines used to construct the main tunnel would start at 'drive shafts' and be removed via 'reception shafts'. A shaft may serve as both a drive shaft and a reception shaft.

Connection tunnels

5.6.7 Two long connection tunnels would be required in order to connect five remote CSOs to the main tunnel. The tunnels are known as:

a. the Frogmore connection tunnel (approximately 3m internal diameter and approximately 1.1km long), which would be situated in the London Borough of Wandsworth

b. the Greenwich connection tunnel (approximately 5m internal diameter and approximately 4.6km long), which would pass through the London boroughs of Southwark and Lewisham and the Royal Borough of Greenwich.

5.6.8 A series of shorter connection tunnels would also be necessary to connect various CSOs that are close to the main tunnel.

Site types

5.6.9 Twenty-four worksites were selected in total, which can be categorised by function as follows:

a. five ‘main tunnel sites’: to construct the main tunnel, which can be further classified as ‘drive sites’ and/or ‘reception sites’, depending on the direction in which the tunnel boring machines would be driven

b. sixteen ‘CSO sites’: to construct the CSO drop shafts and interception structures and to drive or receive connection tunnels

c. two ‘system modification sites’ to control CSOs locally rather than connecting them to the main tunnel

d. Beckton Sewage Treatment Works: to lift the combined sewage flows from the main tunnel system and transfer them for treatment. This site also requires a siphon tunnel to bypass the pumping mechanism when the tunnel system is full.

Above-ground permanent works

5.6.10 Some permanent above-ground infrastructure would be required, which would vary according to the type of site. This infrastructure might include:

a. ventilation structures, ventilation columns and air treatment facilities

b. a kiosk structure to house electrical and control equipment

c. a means of access

d. areas of hardstanding adjacent to shafts and structures to enable periodic inspection and maintenance.

5.6.11 Maintenance visits would be required approximately every three to six months for above-ground equipment inspections and every ten years for tunnel and shaft inspections.

5.6.12 Construction sites would be restored on completion of the works by means of levelling, in-filling, landscaping and making good.

6 Sustainability statement

6.1 Introduction

6.1.1 This section provides a summary of the project's performance against the sustainability objectives under the following themes:

a. water quality
b. biodiversity
c. climate change mitigation
d. change adaptation and flood risk
e. excavated materials and waste management
f. resources and raw materials
g. population, human health and equality
h. economy
i. environmental protection and enhancement
j. land use
k. sustainable transport.

6.1.2 In sustainability terms, many of these thematic areas are fundamentally interlinked, often with overlaps, conflicts and synergies existing between them. The *Sustainability Statement* explains the links between these thematic areas, and the bearing this has on sustainability.

6.2 Water quality

Background

6.2.1 Water quality in the tidal Thames has generally been improving since the 1960s. However despite this, tighter standards and regulation brought about through the Urban Waste Water Treatment Directive (1991) (UWWTD) and Water Framework Directive (WFD) mean that the tidal Thames is currently failing to meet its water quality targets. The main reason for this is the 39 million m^3 of untreated sewage discharged to the tidal Thames from CSOs during a typical year. The water quality of the tidal Thames is expected to worsen if no actions are taken.

6.2.2 The London Tideway Improvements, of which the Thames Tideway Tunnel project is part, would bring about significant improvements to the water quality within the tidal Thames.

Planning policy and drivers

6.2.3 The UWWTD concerns the collection, treatment and discharge of urban wastewater. The Directive is enacted to protect the environment from the adverse effects from wastewater discharges, such as those occurring in the Thames. In 2004, the European Commission initiated infraction

proceedings against the UK government, alleging that it has failed to fully implement the UWWTD correctly with respect to overflows from the sewer network in London. On the 8 October 2009, the European Commission announced its decision to take the United Kingdom to the European Court of Justice for breach of the UWWTD. This action was taken on the basis that urban wastewater collecting systems and treatment facilities in London are not considered to be compliant with EU legislation[12]. In October 2012 the Court found against the UK, and the European Commission may try to seek fines upwards of £100 million a year (Defra, 2011)[13]. This shows that failure to act could have significant fiscal implications for the UK, which emphasises the economic risks.

6.2.4 The need for the tunnel is also driven by the WFD, and the regulations set within the UK. The WFD sets objectives relating to surface water quality to be achieved by 2015, 2021 and 2027, whereby the tidal Thames would need to meet bespoke dissolved oxygen standards and move towards 'good ecological potential', a metric of water quality able to support aquatic life in heavily modified water bodies.

6.2.5 In accordance with the WFD, the Environment Agency prepared a series of *River Basin Management Plans*. The *River Basin Management Plan for the River Thames* (2009), states that the London Tideway Tunnels (the Thames Tideway and Lee tunnels) "represent the primary measures to address point source pollution from the sewer system and are fundamental to the achievement of good status in this catchment". The Environment Agency recognise that the London Tideway Improvements (Thames Tideway and Lee tunnels and STW expansions) alone would not allow the tidal Thames to reach 'good ecological potential' but would have a significant impact on moving the river closer to the standard (*Needs Report*).

6.2.6 The NPS recognises the need for the project to address water quality in the tidal Thames. It also sets out a requirement to assess the effects of the project on water quality. It highlights that in making a decision, the authority will "generally need to give impacts on the water environment more weight where a project would have adverse effects on the achievement of the environmental objectives established under the Water Framework Directive" Paragraph (4.2.7). The authority should also be satisfied that the project has had regard to the relevant *River Basin Management Plan*, including any objectives set out within them (HM Government, 2012)[14].

6.2.7 The *London Plan 2011* also provides a key driver in relation to the protection and improvement of water quality and the efficient use of water resources within London (GLA, 2011)[15]. This is developed more specifically within the *Mayor's Water Strategy*, which sets out twenty actions to improve London's use of, and effect on water resources, including one focussed on reducing CSO discharges (GLA, 2011)[16]. The Mayor has shown support for the Thames Tideway Tunnel in the London Plan and the Water Strategy.

6.2.8 Maintaining and enhancing the water environment is also an important part of Thames Water's sustainability strategy, which reflects the important

and close relationship the company has with the water environment. Two out of nine of its sustainability themes relate to 'Precious Water' and 'Sustainable Drainage', which include preventing sewer flooding and pollution.

The sustainability objective

6.2.9 Having regard to the relevant policy context, the government's AoS and Thames Water's sustainability themes, the sustainability objective that has been defined for the project is 'to maintain and enhance river water quality'. This has been adapted from the government's AoS objective, which is to 'maintain and enhance water resources and quality', reflecting that water as a natural resource is addressed under the resources and raw materials section. Further details on water resources are provided in Section 6.7. Details about the selection of the objective are provided in the Water Quality Section (Appendix A).

Sustainability appraisal

To maintain and enhance river water quality

6.2.10 The Thames Tideway Tunnel project, alongside wider initiatives through the London Tideway Improvements would be of considerable benefit for water quality within the tidal Thames. This is highly material in sustainability terms, and a substantial benefit which would be realised once the tunnel is operational.

6.2.11 In delivering the project, there is potential to affect water quality during the project's construction phase due to the need to undertake deep excavation works, and operate in work sites which are in, or adjacent to, the tidal Thames in the foreshore. These risks would be mitigated by practices defined and managed through the adoption of the *Code of Construction Practice* (*CoCP*). This requires that various control measures are put in place at the work sites.

6.2.12 The construction of CSO drop shafts and main tunnel shafts has the potential to affect groundwater quality, predominantly through the creation of contaminant pathways from grouting and groundwater mixing. These risks are elevated where excavations penetrate a groundwater aquifer. When operating in these areas, it is necessary to remove this groundwater, reducing its pressure to create a safe and secure working environment. The dewatering process can have effects on mobilising contamination. It can also reduce the availability of groundwater for others in the area that hold licences to abstract this water. Where necessary, specialist 'restricted' dewatering activities would be enacted, minimising the drawdown of the aquifer to a more localised area. Other controls, such as minimising the use of grout and using EA approved grouts, would reduce the risks of contaminating groundwater.

6.2.13 In working close to surface water bodies, particularly the tidal Thames, construction activity may give rise to the potential of spills or sediment loads entering surface water bodies. The project's *CoCP* sets out the rigorous control measures to mitigate such risks, which include working practices to reduce the potential for spillage to occur.

6.2.14 The operation of the Thames Tideway Tunnel project (in conjunction with the overall London Tideway Improvement Scheme) would result in a significant reduction in CSO discharges to the river and allow the tidal Thames to meet the requirements of the UWWTD and help address the requirements of the WFD. The existing system currently discharges 39 million m^3 of untreated sewage to the tidal Thames in a typical year and some CSOs discharge over 50 times a year, the improvements would reduce spillages to approximately 4 times per year. It is predicted that these reductions would be maintained throughout the operational lifetime of the project, although may increase to 5 spillages per year when taking account of climate change. This would still be within the limits agreed by the EA.

Summary

6.2.15 Strategic studies demonstrate that the Thames Tideway Tunnel project, in combination with the other London Tideway Improvements, is required to meet the UK's legal obligations under the UWWTD. It would contribute towards meeting the EA's targets for improving the water quality in the Thames in line with the WFD (Thames Water, 2012)[17], (Defra), 2011)[18]. Further information is also provided in the *Needs report.*

6.2.16 With regard to the sustainability objective, Thames Water would enact controls to reduce impacts in river water quality and groundwater during construction. Once in operation, the Thames Tideway Tunnel project would also provide the necessary capacity to manage the increase in CSO discharge volume expected due to the forecast population growth and climate change within the London sewer catchment area (see Section 6.5). Consequently, it is concluded that there would be a substantial benefit to enhancing water quality and the project will support the sustainability objective.

6.3 Biodiversity

Background

6.3.1 Biodiversity refers to the variety of life on earth. It includes the diversity of individual species, the genetic diversity within species and the range of ecosystems that support them (Defra, 2011)[19]. Despite its urban nature, London holds a variety of habitats and plays host to a number of protected species. The Thames tideway is a Site of Nature Conservation Importance (Metropolitan) of Borough Importance (*Environmental statement glossary*), important because it supports a range of marine and fresh water fish through different stages of their life cycle, while its tributaries are important for species that rely upon their sheltered waters for protection. This makes them ideal for spawning adults and as nursery areas for young fish and as feeding areas for birds.

6.3.2 CSO discharges have adverse effects on the ability of the Thames to support fish species. The breakdown of sewage by bacteria uses up oxygen dissolved in the water, meaning that fish which depend on dissolved oxygen (DO) may be adversely affected by CSO events. Under

certain conditions, low DO can result in fish mortalities. Repeated events, particularly during the summer, can lead to this occurring.

6.3.3 The project therefore has the potential to play an important role in maintaining and enhancing London's biodiversity.

Planning policy and drivers

6.3.4 The decline of biodiversity is a global problem and its reversal receives policy support at the highest levels. The NPS includes policies for biodiversity and geological conservation. It states: "*as a general principle development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives"* (para. 4.5.7). It goes on to state that "*development proposals provide many opportunities for building-in beneficial biodiversity or geological features as part of good design. When considering applications, the decision maker should consider the extent to which the applicant has maximised such opportunities in and around developments*" (para. 4.5.14).

6.3.5 The *London Plan 2011* and *London Biodiversity Action Plan* emphasise the protection and enhancement of biodiversity, particularly for priority habitats and species.

6.3.6 In 2012, Thames Water developed a biodiversity strategy which is focused on improving access to nature[20]. The strategy has various objectives, including those to provide access to nature and to inspire and work with customers, stakeholders and employees on key environmental issues, creating opportunities to enhance biodiversity where they exist.

The sustainability objective

6.3.7 The government's AoS appraised the Thames Tideway Tunnel project against the sustainability objective 'to maintain and enhance biodiversity'. Given the direction of policy and Thames Water's approach to responsible operations, the same objective has been adopted for this sustainability appraisal. Further information on the definition of the appraisal objective is available in Appendix A.2.

Sustainability appraisal

To maintain and enhance biodiversity

6.3.8 European law and UK legislation and policy afford the highest level of protection to Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and internationally important wetlands (Ramsar sites), collectively referred to here as 'European sites'. Regulation 61 of the Habitats Regulations requires the Competent Authority before authorising a project 'to make an appropriate assessment of the implications for that site in view of that site's conservation objectives', otherwise known as a 'Habitats Regulations Assessment' (HRA).

6.3.9 In undertaking a strategic level HRA for a Thames Tunnel solution, the NPS for Waste Water HRA concluded that that the project would not have a significant effect on the following European sites:

a. Lee Valley Special Protection Area (SPA) (also a Ramsar site)
b. South West London Waterbodies SPA (also a Ramsar site)
c. Benfleet and Southend Marshes SPA (also a Ramsar site)
d. Outer Thames Estuary SPA
e. Wimbledon Common SAC
f. Richmond Park SAC
g. Epping Forest SAC
h. Wormley Hoddesdonpark Woods Special Area of Conservation (SAC).

6.3.10 In relation to the Thames Estuary and Marshes SPA and Ramsar site, the NPS for Waste Water HRA concluded that:

6.3.11 "the effects of the two NSIP schemes [Deephams STW and the Thames Tunnel] on the Thames Estuary and Marshes SPA and Ramsar site are uncertain, and therefore that a detailed Appropriate Assessment will be required at the project level on the basis of a more clearly defined scheme specification and design."

6.3.12 HRA screening of the potential effect of the Thames Tideway Tunnel project on European sites, has concluded beyond reasonable scientific doubt that there would be no Likely Significant Effects on any of the above European sites, either alone or in-combination with other projects and plans.

6.3.13 Natural England has been supportive of the project, and have stated that they are in agreement with the approach and methodology Thames Water has taken to the HRA, as well as the conclusions drawn by the assessment. Further details are available within the Habitats Regulations Assessment: *No Significant Effects Repor*t which accompanies the application.

6.3.14 Potential impacts on terrestrial and aquatic ecology have been assessed within the *ES*. The effects of the project on terrestrial ecology have been assessed to be not significant across the project as a whole, both during construction and operation. This is because the sites selected for development generally have low ecological value, and the extent of construction work would not impact significantly on any designated sites, habitats and notable species. Notwithstanding, some sites have the potential to support birds and bats, which have been subject to species surveys. In all cases a robust portfolio of mitigation has been developed. This has been embedded in design where appropriate and would be further controlled through the *CoCP*.

6.3.15 Various considerations have been applied to limit impacts during construction. For example:

a. sites have been selected with consideration given to potentially sensitive ecological receptors
b. control measures would be employed to prevent spills of chemicals or silty water into the river during construction

c. restrictions on dredging and piling to protect fish spawning areas

d. use of specialist piling techniques to minimise under water noise and vibration,

e. careful consideration of lighting to minimise disturbance to wildlife.

6.3.16 The potential effects from the project on aquatic ecology have also been assessed at both a site and project wide level. Due to the need to intercept CSOs, a number of sites require works adjacent to, or within the foreshore of the tidal Thames.

6.3.17 As part of this construction work, approximately 6ha of foreshore would be affected, with 1.3ha permanently lost to development. The relationship between foreshore structures and aquatic ecology is complex, and has been the subject of extensive modelling. New structures can modify the ability of juvenile fish to use the shallows, potentially forcing these fish into deeper, faster waters where they may be more at risk to predation. This is potentially in conflict with the sustainability objective, however these new structures also provide refuge to fish species, slowing the water in places offering areas to rest and feed. Various design measures have been included to create habitat on new foreshore structures.

6.3.18 Across the project, mitigation and enhancements for both terrestrial and aquatic ecology would be implemented where necessary.

6.3.19 Examples include:

a. to seek a net gain in native tree species across the project

b. design principles include biodiversity roofs on certain buildings and sites

c. bird and bat boxes and other species enhancements

d. provision of timber fenders on permanent foreshore structures to promote aquatic habitats

e. terracing on foreshore sites to encourage biodiversity and provide refuge for fish.

6.3.20 Once in operation, the Thames Tideway Tunnel project is expected to yield substantial benefits for fish species. This would be realised through a reduction in wastewater entering the River Thames and a consequent reduction in the occurrence of low dissolved oxygen related fish mortalities. The direct improvements predicted for water quality of the Thames would have an impact on the number of species able to survive and live within the river. Such benefits would increase in time (six years and upwards), as a greater number of pollution sensitive fish species are able to permanently re-colonise the Thames.

6.3.21 There would also be an improvement in the quality of foraging habitat for birds and invertebrate populations as a result of improved dissolved oxygen levels and reductions in other chemicals such as ammonia. Further details on these benefits are available within the Aquatic Ecology section, Volume 3 of the *Environmental Statement*.

Summary

6.3.22 The sustainability objective 'to maintain and enhance biodiversity' is strongly supported by the project proposals. In general, adverse effects on aquatic and terrestrial ecology have been minimised during construction, albeit some significant effects would occur. There are no predicted effects on the European designated habitats that would necessitate further assessment through an *HRA*. Furthermore, substantial benefits to ecology within the tidal Thames are expected through the control of point source pollution once the tunnel is operational. The benefits of this would increase over time, as species are better able to recolonise the Thames. In conclusion, the objective is achieved, particularly over the long term.

6.4 Climate change mitigation

Background

6.4.1 The *Stern Review Report* (2006) identifies that the scientific evidence supporting climate change is overwhelming. Research demonstrates an increase in global temperatures over the past 150 years. Climate change presents severe global risks and demands an urgent global response.

6.4.2 Climate change mitigation refers to limiting the effects of climate change by reducing the concentrations of greenhouse gases in the atmosphere. According to the EA, the water industry directly produced five million tonnes of CO_2 in 2007/8 (Environment Agency, 2009)[21]. Other industries produce considerably greater levels of CO_2, however it is recognised that energy demand (directly linked to CO_2 emissions) for wastewater treatment is likely to rise in the future due to:

a. increasing population

b. pressures from climate change

c. increasingly stringent requirements on water treatment.

6.4.3 Climate change mitigation is therefore an important factor in the project's planning.

Planning policy and drivers

6.4.4 Policy places strong emphasis on mitigating greenhouse gas emissions. The NPS identifies that the approach taken for mitigating greenhouse gases in new infrastructure projects, should be in line with Defra's mitigation plans to help deliver the UK's obligation under the Climate Change Act (2008). This should be achieved within the context of the EU Emissions Trading System (para. 2.2).

6.4.5 The Climate Change Act introduced legally binding targets for greenhouse gas reductions. The UK Government has committed to an 80% reduction of emissions by 2050, relative to 1990 levels. To assist in meeting this target, it established mandatory five-year carbon budgets, which set a ceiling for the amount of emissions able to be released into the atmosphere. The Climate Change Act made provisions to form the

Committee on Climate Change (CCC), whose role it is to advise government on the carbon budgets and priorities for decarbonisation. The four carbon budgets produced to date cover reductions through, and up to the end of the 2020's. These do not specifically focus on the wastewater industry, but do recommend specific reductions from the electricity supply sector. This will have an important effect on the Thames Tideway Tunnel, which would utilise grid derived electricity in operation. As a result of this the tunnel would utilise progressively lower carbon electricity in the future.

6.4.6 At the regional policy level, Chapter 5 of the *London Plan 2011* sets out London's response to climate change. It introduces strategic targets for mitigating carbon emissions within the capital, seeking a 60% reduction in emissions relative to 1990 levels by 2025. This reduction represents a steeper trajectory to decarbonisation than that set by the Climate Change Act, emphasising the importance of low carbon growth to London. The *London Plan 2011* also sets other policies for reducing emissions from new development, through the application of an 'energy hierarchy' and targeting improvements over and above those capped by Building Regulations.

6.4.7 Thames Water's commitment to tackling climate change is set out in its Climate Change Policy (2011), which is taken into account across all its business operations, including new projects like the Thames Tideway Tunnel. Its corporate commitment, as well as the need to achieve relevant policy within the NPS, drives the project to reduce emissions in design and construction as far as practical and economic.

The sustainability objective

6.4.8 In light of the drivers above, Thames Water has set the objective to 'maximise energy efficiency and minimise the carbon footprint of the project'. This objective is different to that applied within the government's AoS; which was 'to minimise detrimental effects on the climate from greenhouse gases and maximise resilience and adaptability to climate change'. Climate change adaptation is considered in the next section (6.5). This section focuses on the steps Thames Water has taken to maximise energy efficiency and minimise the carbon footprint of the project. Further information on the definition of the sustainability objective is provided in Appendix A.3.

Sustainability appraisal

Maximise energy efficiency and minimise the carbon footprint of the project

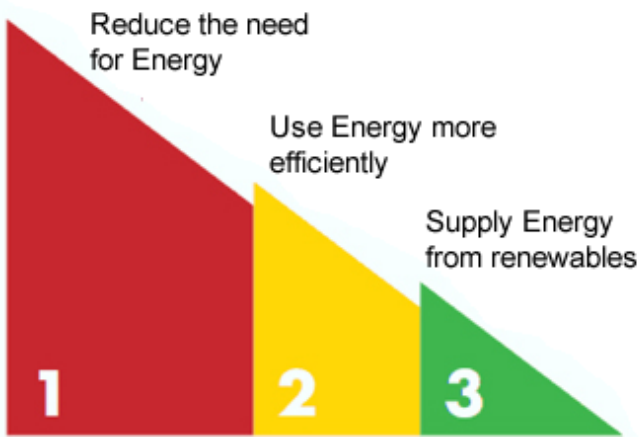
6.4.9 The government's AoS of the NPS for Waste Water considers the effects of implementing a Thames Tunnel solution on strategic objectives for climate change. It identifies that there will be significant energy requirements associated with the operation of the tunnel boring machines, construction traffic, and pumping dewatering discharges during construction.

6.4.10 An *Energy and Carbon Footprint Report,* submitted with the application, identifies energy requirements and carbon associated with the tunnel's

construction and operation. The assessment has helped Thames Water to identify particularly carbon intensive aspects of the project, providing a better understanding of the areas where interventions may make a material reduction on the carbon footprint of the project.

6.4.11 Energy and emissions are being addressed within the framework of a hierarchy, similar to that endorsed in the *London Plan 2011.*This approach ensures that energy use is minimised by design, before applying other energy efficiency measures and renewable energy. The general steps in the hierarchy are shown in Plate 6.4.1 below.

Plate 6.4.1 Energy hierarchy



Construction emissions

6.4.12 The construction of the tunnel would be an energy intensive process, requiring grid electricity to power the tunnel boring machines, as well as for a number of other construction related activities. The full scope of activities is assessed within the *Energy and Carbon Footprint Report*.

6.4.13 A major factor influencing energy requirements in construction relates to tunnel design. The tunnel length and alignment has been optimised to address the most polluting CSOs, now and in the future, while protecting water quality in line with EU and related UK regulations. The proposals to adopt the shortest route alignment from the three options presented at the phase one consultation, leads to direct savings in energy and emissions both in construction and operation. Factors contributing to this, include:

a. reduced energy in construction from the operation of tunnel boring machines

b. fewer materials are required in construction

c. a reduced amount of excavated materials requiring transport

d. reduced energy required in operation, because of the reduced pumping activities at Beckton.

6.4.14 The *Energy and Carbon Footprint Report* identifies that the CO_2e per kilometre of tunnel is approximately 33,000 tonnes. The savings from the River Thames route to the Abbey Mills Route alone is estimated to be 199,000 tonnes of CO_2.

6.4.15 Another important factor of design has been to intercept as close to the overflow as possible, reducing the length of connection tunnels required. In certain cases, intercepting CSOs upstream of pumping stations reduces the need for existing CSO pumping activities, albeit pumping activities at the Abbey Mills pumping station into the Lee tunnel would still be required.

6.4.16 The *Energy and Carbon Footprint report* has also identified the emissions embedded in the primary materials used for construction and for transport logistics. Construction materials in particular represent over 83% of the total carbon emissions of the project over its lifecycle. The majority of this is inevitable to construct the tunnel and to ensure durability over a 120 year design life.

6.4.17 Measures to control the carbon in construction would be explored via provisions made in the *CoCP* and through the procurement process, these include:

a. integration of renewable energy for temporary construction compounds

b. attempting to minimise the double handling of materials through construction logistics

c. requiring contractors to develop energy management plans, expressing ways that they would promote energy efficiencies and minimise the carbon footprint of the project

d. requiring contractors to monitor their CO_2 emissions arising from site activities and from transportation and report these back to Thames Water for collation, with a view to identifying the success of control options.

6.4.18 Furthermore, through the requirement to produce energy management plans, contractors will be encouraged to consider the opportunities for substituting materials, such as cement, with lower carbon alternatives. The ability to achieve this will be restricted by the over-riding importance of tunnel durability and commercial viability, which is a primary driver for the tunnels design. However such interventions, where appropriate, do present significant opportunities for decarbonising the tunnel. For example the specification of 25% Pulverised Fuel Ash (as assumed within the Energy and Carbon Footprint Report) saves approximately 20,000 tonnes of concrete for each kilometre of tunnel. Increasing this content, may generate even greater savings.

Operational emissions

6.4.19 The energy and CO_2 footprint associated with the tunnel's operation has also been assessed. In operation the anticipated energy requirements will be from pumps (at Beckton) and fans at Carnwarth Road and Acton Storm tanks where there is active ventilation. The *Energy and Carbon Footprint Report* calculates this use to be approximately 8.5 GWh per year, or 1016 GWh over the design lifetime of the tunnel. These energy requirements have been minimised through the following design principles:

a. Tunnel gradient – the tunnel is self cleaning, reducing the need for purging and allowing the material to flow west to east under gravity.

b. Air management strategy – designed specifically to limit fans in operation. Three new active ventilation sites would be required for the Thames Tideway Tunnel, the remainder of the tunnel would be ventilated by a passive design.

6.4.20 The NPS recognises that the development should accord with targets and mechanisms outlined in the Climate Change Act (2008). The carbon intensity[i] of grid electricity is anticipated to reduce through the 2020's with major action to decarbonise the energy supply sector. As electricity would be the primary energy source for the tunnel, the implications of this would mean that the electricity used by the time of operation would be lower carbon than if it was supplied by today's power.

6.4.21 The opportunity to use renewable and or low carbon energy has been evaluated. The Energy and Carbon Footprint Report identifies the technology solutions which have been considered. Whilst no single technology solution would form part of the DCO application, such opportunities would be considered through further design.

Summary

6.4.22 In summary the project would inevitably require energy and generate CO_2 emissions during its construction and operation. As the large majority of the CO_2 is embedded in construction materials, there are limited practical options available to mitigate these emissions directly, other than to influence contractor behaviour through the procurement process. Although as previously identified, significant carbon savings have been achieved through design development. Opportunities would continue to be taken to reduce the carbon footprint of the project, where possible, through encouraging contractors to explore options during detailed design and construction, and reporting back to Thames Water their strategies for doing this through energy management plans.

6.5 Change adaptation and flood risk

Background

6.5.1 'Change' is an important consideration in the design of infrastructure. Infrastructure is typically designed for the long-term, therefore the effects of change, both in terms of a changing climate and a changing population are more pronounced. This section also addresses flood risk, which is closely associated with climate and land use change.

6.5.2 As discussed previously, it is important to mitigate CO_2 and greenhouse gas emissions to prevent the worst effects from climate change from occurring. Variations are expected in the future patterns and frequencies of droughts and other extreme weather events. Due to Thames Water's close dependence on the natural environment, the impacts of climate change are an important issue and integral to its business planning,

[i] Carbon intensity refers to the amount of carbon by weight emitted per unit of energy consumed

including the development of new infrastructure assets (Thames Water, 2011)[22]. The number and volume of CSO discharge events is directly associated with the amount of rainfall falling over the sewer catchment and the water quality of the river will also be influenced by a changing climate affecting parameters such as water temperature and flow. It is therefore vital that the effects of climate change are understood and are planned for.

6.5.3 The project has also taken account of increased population in the future which could increase the dry weather flow in the sewers and reduce capacity for rainfall run-off. When the first interceptor sewers were built in the 1850-1870s the population of London that the system served was approximately two million. With Victorian foresight the interception sewers were designed for a population of four million. Since this time, a number of additional sewers have been constructed to meet the demands of a growing population in London. Today population specifically within the Beckton and Crossness Sewage Treatment Works catchment of London has almost reached six million people, and is still rising.

6.5.4 The project has a design life of 120 years. In this timescale significant changes are projected for climate and population. This will influence the performance of the project. The Thames Tideway Tunnel is designed to meet the requirements of the near future but must also be adaptable to these longer term changes.

6.5.5 The tunnel is sufficiently sized to capture the required volume of CSO discharge during diverse rainfall events and so meet the UWWTD, but is balanced economically and particularly so as to not produce excessive amounts of excavated material and waste or require the greater energy demand associated with more construction. The sustainable design of the project strikes this balance, with the need to be resilient to the effects of change at the heart of this.

6.5.6 Extensive analysis has shown that the project is resilient to potential change throughout its design life. Prudent adaptation measures have been identified in the *Resilience to Change* report which could be implemented in the future if required, but modifications to the current design of the Thames Tideway Tunnel project are not necessary.

Planning policy and drivers

6.5.7 Government holds a vision to have an infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate (HM Government, 2011)[23]. Due to the importance infrastructure has for the economy and future growth, government is prioritising its efforts to make infrastructure resilient to climate change. An Adaptation Reporting Power has been established under the Climate Change Act (2008), allowing the government to direct certain infrastructure companies and regulators to prepare reports on how they are assessing and acting on the risks and opportunities from climate change. Thames Water is obliged under the Act to prepare these reports every five years; its first response to its 'direction to report' was published in January 2011 (Thames Water, 2011)[24].

6.5.8 The NPS for Waste Water includes policies on climate change adaptation and separate policies on flood risk (para. 3.2.7). Paragraph 3.6.3 of the NPS identifies that climate change is likely to mean changes in future weather patterns; with warmer temperatures, continued sea level rise, change to seasonal rainfall and more extreme events. This will cause an increase in the risk of both flooding and drought. The NPS advises that the application should set out how the proposal will take account of the projected impacts of climate change. The relevant requirements are described in Section 3.6 of the NPS. Paragraph. 3.6.8 states that the decision maker should be satisfied that the proposals have taken into account the potential impacts of climate change using the latest UK climate projections available at the time the *Environmental Statement* is published.

6.5.9 The NPS includes separate policies for Flood Risk as part of the 'Generic Impacts' for assessment. Paragraph 4.4.10 establishes the information which should form the basis of Flood Risk Assessments (FRAs) required in support of development consent applications. The NPS acknowledges that within the lifetime of NSIPs, climatic factors will lead to increased flood risks in areas susceptible to flooding. Such factors may also increase flood risk in areas which are not currently thought of as being at risk. Climate change adaptation and flood risk are therefore closely related; and addressed as a linked issue within this section.

6.5.10 At the regional level the *London Plan 2011* includes policies and strategies for climate change adaptation and various policies for flood risk. The Mayor of London's *Climate Change Adaptation Strategy* (2011), specifically includes guidance on how to address climate change within London.

6.5.11 Within its '*Climate Change Adaption Report'* to government, Thames Water has identified a number of climate based risks to infrastructure assets. Specific to sewerage infrastructure, risks include the increased volume of material caused by heavier rainfall requiring treatment and conveyance. The physical risk of flooding has also been identified as a key risk.

The sustainability objectives

6.5.12 Based on the policies and drivers identified above, two sustainability objectives have been applied to the tunnel and are reported under the thematic area of change adaptation. These are to 'maximise resilience and adaptability to change'; and 'take account of flood risk in the design of sites'. Both objectives have been modified from those applied within the Government's AoS. Further details on the selection of these objectives are given in the change adaptation and flood risk section of Appendix A.3.

Sustainability appraisal

Maximise resilience and adaptability to change

Population change

6.5.13 Population change is an important driver for the project and requires that appropriate and timely action is taken now to avoid exacerbating an

existing poor situation. The volume of foul flow within the sewers and arriving at sewage treatment works is directly related to population. As such, future growth has been considered when investigating the project's resilience to future population change.

6.5.14 The design of the system takes into account estimated growth within the capital from information held by the Greater London Authority (GLA). The GLA project future population increase in every political ward covered by the Beckton and Crossness catchment with the exception of the City of London. The projections extend up to 2031 and estimates for subsequent years beyond that, up to the 2080s, are based on predictions from the Office of National Statistics (ONS). These have been taken into account during the design of the Thames Tideway Tunnel project and wider London Tideway Improvement Works to ensure that the tunnel would continue to provide the functional role intended.

Climate change

6.5.15 The benefits from the Project could be considered to be greater when considered in the context of climate change. Without the project, more winter rainfall would increase CSO volumes and trigger additional CSO events. Consequently, the frequency and severity of discharges would increase in the future. Similarly a change in the summer climate, leading to warmer river temperatures, will mean that those discharges which do occur will be more harmful to river ecology because dissolved oxygen will be lower. However, as examined in the *Needs report*, although the worst effects from climate change will be felt some time in the future, there remains a need to act now to implement the Thames Tideway Tunnel project and meet the environmental objectives. As a result of this, climate change cannot be seen as a driver for the project, but as another aspect that must be addressed within design.

6.5.16 The NPS requires that applicants for new waste water NSIPs demonstrate how they have addressed projected climate change in the design of new wastewater infrastructure. This should be done with regard to the latest climate change projections. The UKCP09 provides an estimate of the future climate, addressing uncertainties in the future projections, along with high, medium and low emissions scenarios. In accordance with the requirements of the NPS, Thames Water has simulated London's climate up to the 2080s to assess future climate risks, taking account of the best available climate projections for the UK, the UKCP09. The design reflects how it is resilient to these different scenarios. This approach has been undertaken with advice sought from the Environmental Change Institute of University of Oxford. The modelling is believed to be the most comprehensive of its type in the UK, and the findings may aid future climate change adaptation strategies in the country.

6.5.17 An increase in mean summer temperature is predicted in the future, which will be associated with less rainfall and increased river temperatures. The potential effect on the River Thames will be lower flows, which means that when CSO discharges do occur, there would be less dilution; making the effects potentially worse. Furthermore, warmer water has the effect of

accelerating metabolic rates of bacteria, reducing the level of dissolved oxygen available for fish species and other aquatic ecology.

6.5.18 On land there will be an increase in air temperatures at ground level, particularly in central urban areas which has limited green space to absorb this heat. The Mayor of London has identified the potential effects and strategies for addressing the 'urban heat island effect'. Such strategies include the integration of landscaping into new development, the inclusion of open water and design strategies to reduce reliance on air conditioning.

6.5.19 Water saving measures have been considered for the project. These are discussed further in the resources and raw materials section.

To take account of flood risk in the design of sites

6.5.20 Much of London is categorised as being at high risk of flooding from the tidal Thames. This flood risk typically follows the river corridor, varying in areas due to local topography and flood protection measures.

6.5.21 The site selection process has generally identified sites within a corridor 500m from the river. There are however exceptions, for example at Acton Storm Tanks. For the main tunnel drive sites, the benefit of river proximity has been to exploit the availability of river transport for the transit of resources onto sites, and the removal of excavated materials. For CSO sites, the desirability to intercept overflows as close to the CSO as possible, reducing the need for long connection tunnels has been a main driver. Consequently, many of the sites proposed for development (and most alternatives considered) are either adjacent to, or on, the foreshore of the River Thames.

6.5.22 The NPS requires that applicants produce Flood Risk Assessments (FRAs) which set out how flood risk has been taken into account. For development with flood zones 2 and 3, FRAs should apply the Sequential Test, and for development within flood zones 3b, these should address the Exception Test, which considers whether the overall sustainability benefits of the project outweigh flood risk considerations (Part a), while ensuring the development is safe and does not increase flood risk elsewhere (Part c).

6.5.23 A project-wide FRA has been prepared to assess the effects of construction and operation, at all sites within the project and across the Thames Tideway. In addition to the project-wide assessment, a site-specific FRA has been undertaken for each site. All relevant available information on flood risk has been collated and used to inform the design of individual sites as well as the level of detailed flood risk assessment required.

6.5.24 The project-wide FRA applies this Exception Test with reference to the NPS and this *Sustainability Statement* and concludes that the Exemption Test would be passed, as the sustainability benefits of the project, outweigh the risks posed by flooding (Part a of the Test). It also identifies that part c of the Test would be met as the tunnel does not increase flood risks elsewhere. A hydraulic modelling study has also been completed as part of the project-wide FRA to assess the impacts of the proposed foreshore works on flood risk. The assessments have shown that the tidal

phase of the river is in fact slowed down slightly at certain points as a result of foreshore structures, associated with both the temporary and permanent works, and that there would be no related mitigation as part of foreshore works. This project-wide FRA considered all other sources of flood risk throughout the project area. No project-wide risks from surface water, ground water, sewers or artificial sources have been identified.

6.5.25 At the site level flood risk varies from site to site, and from different sources of flooding. The following would be taken into account:

a. The earthworks, and other works near to existing flood defences could damage or impact these structures. The *CoCP* requires that contractors take such impacts into account, and employ specialist construction techniques and monitoring to limit any potential effects.

b. Flood risk mitigation during construction is outlined within the *CoCP*.

6.5.26 The Thames Estuary 2100 plan is supported by the proposals. New flood defences would be designed to match current flood defence levels at the sites. The design of defences offer potential for raising flood defence levels in accordance with the objectives of the TE2100.

Sustainable drainage

6.5.27 In defining the need for the project, the government have undertaken strategic assessments which considered alternative options for addressing the CSO problem. This included the large-scale adoption of sustainable drainage systems (SuDS) within the capital to manage rainfall-runoff. Thames Water supports the efficient application of SuDS which can provide an increasingly important mechanism for the management of surface water in the future. SuDS alone, however, will not provide a technically feasible or economically viable control measure to address the current CSO discharge problem. Further details are available within the *Needs report*.

6.5.28 SuDS have been considered in the design of permanent sites, ensuring that any new development caters for future increases in rainfall including increases in the intensity of rainfall from climate change. Key proposals include:

a. All sites would include drainage systems considered against the SuDS hierarchy, although SuDS have not always been practical.

b. Where applicable, SuDS standards would reflect attenuation levels similar to that of the Mayor's 'essential standards', however where sites are adjacent to the river, direct discharge to the river would occur at low water. Further information is available within the *Design Principles*, submitted in support of the application for Development Consent.

Summary

6.5.29 The sustainability objectives would be supported by the project. The design of the system ensures that it is resilient to the effects of change, both from an increasing population and also from a changing climate. The *Resilience to Change* report examines how the project would continue to

be effective under different climatic scenarios, maximising its resilience to change. Flood risk has also been an important consideration for the project, particularly from the effects that in-river structures would have and from surface water management. Any in-river structures are not considered to worsen flood risk. Furthermore, the design of permanent sites would take account of flood risk through the application of SuDS where practical and possible, to limit flood risk on and off-site.

6.6 Excavated material and waste management

Background

6.6.1 The NPS identifies that all large infrastructure projects are likely to generate hazardous and non-hazardous waste during the construction, operation and decommissioning phases.

6.6.2 The project would require the excavation of large volumes of material at several sites throughout London. The material would arise primarily from the construction of the main tunnel, however would also come from the construction of shafts and connection tunnels between the main tunnel and the intercepted CSOs. Approximately 4.9 million tonnes of excavated materials are predicted to derive from these activities; which presents challenges for the project and shapes the way the tunnel is designed and constructed.

Planning policy and drivers

6.6.3 Waste policy in the UK focuses on sustainable waste management. In general terms, hazardous and non-hazardous waste should be managed in such a way to protect human health and the environment, by producing less waste and by using it as a resource wherever possible. Where not possible, regulation ensures that waste is disposed of in a way that is least damaging to the environment and to human health.

6.6.4 The NPS requires that applicants for new NSIPs demonstrate that waste will be appropriately managed, both on-site and off-site in line with the waste hierarchy (para. 4.14.1).

6.6.5 Regional waste policy within the *London Plan 2011* and supporting guidance in the *Mayor's Business Waste Strategy for London* (2011) sets out priorities for Waste Management to 2031. The strategy covers both commercial and industrial waste (C&I); and construction, demolition and excavation waste (CDE), which is more relevant to the project. The strategy sets a target to reuse, recycle and compost 95% of CDE waste by 2020. The Mayor's policy aims to drive improvements in resource efficiency by designing out waste at source, and by promoting best practice in reuse and recycling of all materials.

6.6.6 Waste is also an important part of Thames Water's operations, particularly in the management of sewage sludge. One of Thames Water's nine sustainability themes relates to efficient operations. During 2011, Thames Water managed over 259,384 tonnes of dry solid waste material from sludge,[25] 100 % of which was put to beneficial use, sending none to landfill.

The sustainability objective

6.6.7 To reflect policy within the NPS and Thames Water's corporate aspirations, the sustainability objective has been established to 'Minimise waste arisings and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use'. This has been adapted from the AoS objective, to include the term 'beneficial use', which reflects the importance of using materials arising from the construction and operation of the tunnel in a beneficial way. Further details are available in Appendix A.5.

Sustainability appraisal

Minimise waste arisings and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use

6.6.8 As stated above, the project would generate large volumes of excavated materials through tunnelling activities. Waste production would also occur through the materials required in construction, and from the workforce. The *Excavated Materials and Waste Strategy, (*appended to Volume 3 of the *ES)* includes an assessment of the waste arising, and identifies ways in which this material can be managed in accordance with the waste hierarchy, which is both a legal requirement and a guide to achieving sustainable waste management.

6.6.9 The *Excavated Materials and Waste Strategy* holds three objectives, which reflect national policy and Thames Water's corporate sustainability principles:

a. to minimise waste to landfill by prioritising prevention and seeking to maximise reuse and recycling

b. to maximise beneficial use of excavated material arising from tunnel construction

c. to minimise the impact of excavated material and waste on the environment and communities.

Minimising waste

6.6.10 The government's Waste Review (2011) identifies reforms in waste policy to limit the impacts of waste and to move toward a 'zero waste economy'. A zero waste to landfill solution for the project means making the most efficient use of resources, by minimising demand for primary resources and maximising the reuse, recycling and recovery of resources instead of treating them as 'waste'. In practice achieving absolute performance against this is not practical or feasible; because there will always be some waste, whereby from a life-cycle perspective, landfill is the most appropriate action. The Government recognises this in its Waste Review (2011) *"absolute prevention of waste is in many areas unrealistic , prioritising prevention while seeking to re-use and recycle as much as possible of the waste which does arise is however important "*.

6.6.11 The strategy adopted for the project attempts to do this by addressing waste in accordance with the waste hierarchy and promoting beneficial

use of excavated material, ensuring it is put to a good use wherever practical and possible. Through design development, the project has already demonstrated conformity with this. The preferred tunnel option proposed at phase one public consultation is shorter than the other routes considered, with an estimated reduction of excavated material of 476,000m^3 for the Abbey Mills Route.

6.6.12 Thames Water has set the target to divert at least 80% of construction and demolition waste from landfill in pursuit of this objective. A number of proposals have been put forward which support this, and which would be delivered through the CoCP:

a. *Site Waste Management Plans* (*SWMPs*) would be developed and reviewed for each site

b. Where practicable opportunities for the use of materials with recycled content during construction would be adopted

c. Where demolition is required, a demolition waste reuse plan for each site would be produced to maximise reuse opportunities

d. Contractors would be required to provide site workers with appropriate training in on-site waste management and recycling procedures.

Promoting beneficial use

6.6.13 While efforts will be made to prevent waste as far as possible, there would inevitably be excavated materials alongside other waste streams that would arise from construction, and which would require disposal. Efforts will be made to dispose of these materials in such a way which promotes their beneficial use.

6.6.14 For a disposal activity to be classified as 'beneficial use', it must meet a series of tests that have been agreed between Thames Water and the Environment Agency through a series of workshops. Those that have a bearing on sustainability include:

a. The management of arisings would lead to a beneficial reuse and bring land back into use, or provide ecological benefit

b. The material is suitable for its intended use and would not harm human health or the environment

c. Alternative material (whether waste or not) would otherwise be required if material arising from the Thames Tideway Tunnel project was not to be used.

6.6.15 An *Excavated materials options assessment* (*EMOA*) has been developed which applies a sustainability appraisal type process, to develop a preferred list of suitable 'receptor sites' where this material could be disposed. The 'receptor sites' presented perform well against a series of environmental and socio-economic evaluation criteria, as well as specific technical and viability requirements. The preferred list of sites that are credible to take this material, include:

a. former quarries undergoing restoration

b. former landfills undergoing restoration

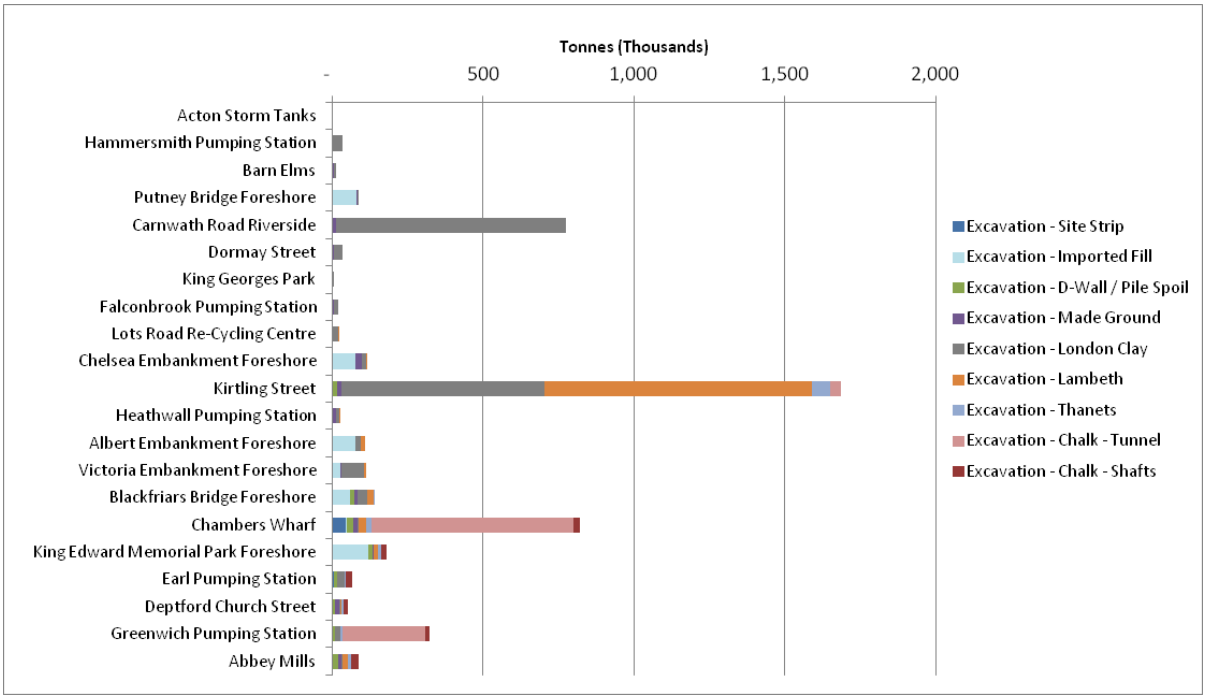
c. habitat creation projects.

6.6.16 Information regarding the sustainability of the preferred receptor sites is available in the *Excavated material options suitability reports* (*EMOR*), appended to the *EMOA*.

6.6.17 In addition to finding the right sites for disposal, Thames Water has set a target in the *Waste Strategy* to beneficially use at least 85% of the excavated materials generated. This target is influenced by the type of material which is excavated, and its ability to be separated and disposed of effectively. London's geology is not consistent along the tunnel route, varying from London Clay in the west, through Thanet sands and gravels in central London, to chalk in the east. The varying ground conditions have a bearing on the tunnelling strategy, influencing factors such as the location of the main drive sites. The varying ground conditions also present challenges for the disposal of the material.

6.6.18 The main groups make up an estimated 86% of the predicted quantity of excavated material by weight, and therefore specific focus has been given to these, to meet with the beneficial use target of 85%. The main excavated materials would arise at the tunnel drive sites (Kirtling Street, Chambers Wharf, Carnwath Road) and through the long connection tunnel at Greenwich Pumping Station (Plate 6.6.1). It is therefore at these sites, and by focusing on these main material groups, where this target would be pursued. Further details are available within the *Excavated materials and waste strategy*.

Plate 6.6.1 Excavated material arisings



Reducing impacts on the environment and communities

6.6.19 Policy requires that waste should be managed in such a way to protect human health and the environment. This outcome would be supported over the longer-term by the reduction in sewage derived litter, which

currently arises from repeated CSO discharges. It was estimated by the *TTSS Steering Group Report* [26] that overflows from the combined sewers introduce approximately 10,000t of sewage derived solid material to the Tidal Thames annually. The impacts of sewage derived litter vary along the Tidal Thames, with greater visual and aesthetic impacts experienced in the western reaches ie, in the Thames Upper water body. It is predicted that the project would reduce this waste stream by approximately 87%.

6.6.20 During construction, it is recognised that the handling of waste, both inert excavated waste, and any hazardous waste that may arise (such as contaminated soil), must be done so with due regard to the environment and surrounding communities. The project's *Excavated materials and waste strategy* takes account of these issues, supported by the following proposals:

a. the proposal to use river freight at various sites, including the main drive sites, where the majority of excavated material is generated

b. restrictions on stockpiling waste on sites and good housekeeping in accordance with the guidelines in the *CoCP* and *SWMPs*

c. Giving consideration to community issues at receptor sites in the *EMOA*.

Summary

6.6.21 Waste would be managed in line with sustainable waste management practices. The proposals put forward have been informed by policy and best practices in London and the UK. The project design demonstrates how it has taken account of the UK waste hierarchy, limiting waste through an optimised (shortened) tunnel route. The *Excavated materials and waste strategy* demonstrates how these considerations will continue to be made, minimising waste and promoting beneficial use.

6.7 Resources and raw materials

Background

6.7.1 The *UK Sustainable Development Strategy* (2005) identifies natural resource protection as one of five priority areas for sustainable development. Infrastructure projects typically require large quantities of resources to construct. For the project, over 1.5 million tonnes of concrete, grout and steel will be required to construct the main tunnel and connection shafts. Fresh water will also be used in construction for concrete and grout production, as well as for various processes such as tunnel boring, wheel washing and dust suppression. Opportunities to promote the sustainable use of resources have been investigated, and would continue to be an important factor as the project progresses. This section explores the theme of resources and raw materials, and the opportunities the project has to manage this.

Planning policy and drivers

6.7.2 The NPS does not set specific policies for the sustainable use of resources, but does recognise the need to re-use and recycle materials through the application of the waste hierarchy (para. 2.2.3), in order to conserve new resources as far as possible.

6.7.3 The NPS also recognises that reducing water consumption by households and industry will in turn help to reduce pressure on the wastewater industry.

6.7.4 The *London Plan 2011* provides more comprehensive guidance for the sustainable use of resources. It includes policies for sustainable design and construction (Policy 5.2), which recognises the importance of efficient use of natural resources (including water). Policies are also included to ensure that London has the capacity to provide recycled aggregates for the construction industry (Policy 5.20). Local policies support sustainable design codes and the principle of resource efficiency.

The sustainability objective

6.7.5 Based on policy and in recognition that construction projects should ensure opportunities for sustainable resource use, the sustainability objective to 'promote the sustainable use of resources' has been defined for the project. This aligns with the sustainability objective applied by the government in the AoS, however has been shortened by removing reference to the delivery of secure, clean and affordable energy', which is addressed under climate change mitigation. Further information on the selection of the objective is available within Appendix A.6.

Sustainability appraisal

Promote the sustainable use of resources

6.7.6 The project would require over 1.28 million tonnes of concrete in construction, including the pre-cast concrete rings, which form the tunnel's main lining, and ready-mix concrete. Over 135,000 tonnes of grout would be required for tunnelling, and approximately 100,000 tonnes of steel is proposed for reinforcing the tunnel. These primary materials are all known to contribute to the depletion of natural resources and the causes of climate change. The consumption of materials is therefore an important issue for the project, and one which will continue to be a focus for the project's sustainability strategy, as it develops.

6.7.7 For the project, the importance of tunnel durability, ensuring that it can withstand a 120 year design life has been, and will continue to be, an over-riding consideration in its design. The project team holds extensive experience in delivering infrastructure in the UK, and understands the challenges of balancing resource efficiency with durability, and the benefits this may have on sustainability over the longer-term.

6.7.8 The Thames Tideway Tunnel project would be a design and build project, meaning that future contractors would undertake the detailed design. It would therefore be at a later stage when decisions are made around resource use, particularly the detailed specification of materials required.

Performance specifications are being developed which guide the future contractors, however ultimately the final materials selected for construction would be developed by the contractors.

6.7.9 A primary performance requirement is the need to construct a durable tunnel, able to tolerate some considerable pressures, both from external ground conditions, but also internally, from the combined sewage itself. For the tunnel to withstand these diverse pressures, it must be designed to certain thicknesses, and at present, the need for a secondary tunnel liner has been identified, which will help to ensure durability and the structural integrity of the tunnel. The durability requirement proposed has been identified as being necessary to ensure the project continues to function over the long-term, with limited maintenance requirements. This in its own right is considered to be a sustainable solution, ensuring that the right investment is made for the future.

6.7.10 Efforts will be made to continually evaluate the specification of materials with a view to improve the sustainability of these materials where practical. The tender process will require contractors to demonstrate how sustainability could be promoted in further design and specification of materials used. Sustainability would be one of a number of considerations that influence the awarding of contracts to the principal contractors.

6.7.11 Thames Water is developing ways in which contractors will be encouraged to innovate. Particular focus would be given to:

a. the procurement process, requiring contractors to hold a materials policy and demonstrate a proven track record of how resource efficiency can be promoted, in accordance with Thames Water's climate change policy and procurement policy

b. requiring the contractors to develop materials management plans through the *CoCP*

c. encouraging contractors to reduce primary aggregates, for example by substituting these with secondary or recycled aggregates

d. consideration to sourcing of materials, including the proximity and methods of handling

e. requiring contractors to use FSC or PEFC timber

f. requiring contractors to demonstrate how they have taken all opportunities to make use of the locally sourced/recycled aggregates for the use on sites and in certain applications.

Water consumption

6.7.12 The project will require water in construction. The government's AoS concluded that in relation to water resources, the effects of a Thames Tunnel solution were uncertain, because the potential impacts of a tunnel on groundwater availability and the effects on current licence abstractions were unknown.

6.7.13 The Thames region is one of the most densely populated water regions in the UK. Consequently, the demand for water resources is high. This is exacerbated by the lower water efficiency in London due to the greater

number of smaller households. Thames Water has identified within its water resources plan that following necessary investment in demand and supply-side measures, the London water resource zone region will have a surplus supply of between 19.4 Ml/d in 2012/13 to 1.4 Ml/d by 2034/35 (Thames Water, 2011)[27].

6.7.14 The majority of water consumption in constructing the tunnel would be at the drive sites, due to the nature of activities taking place. Indeed, nearly 60% of the peak water consumption (expected in 2018) would be used for tunnel or shaft concrete and grouting activities. Across the project as a whole, approximately 762,000 l/24hr of water would be required at the peak of construction. This is equivalent to 0.76 Ml/d, or 0.04% of the total water calculated to be available for London. Given that there is estimated to be a supply surplus of 0.8 Ml/d in 2018, as a result of the partly completed demand and supply measures being implemented during the water resources plan lifecycle, it is not anticipated that water consumption during construction will have a significant effect.

6.7.15 Water consumption outside of peak construction would be considerably less, and once in operation, the project requires minimal water resources. The design of the tunnel ensures it is self cleansing, reducing the need to use water for purging the tunnel.

6.7.16 The following is proposed to manage control of the use of water:

a. requiring contractors to develop *Water Management Plans* through the *CoCP*

b. opportunities to use non-potable water for dust suppression and wheel washing would be explored

c. opportunities to use recycled water for operating the TBMs

d. opportunities to recycle water in concrete batching where space permits

e. landscape planting which requires limited irrigation.

6.7.17 There is a requirement for dewatering during the tunnelling activities. Modelling has been undertaken as part of the *EIA t*o determine the effects on abstraction licence holders. The lowering of groundwater as a result of localised dewatering activities could have adverse effects, however, with appropriate mitigation (predominantly lowering abstraction pumps); the effects are considered to be negligible or minor. Consequently the impact on groundwater resources is not considered to be significant, particularly in the long term, due to recovery. Restricted dewatering would be used where necessary to ensure that impacts on groundwater are minimised.

Summary

6.7.18 The project would inevitably require resources to construct. These would be essential to achieve the long-term durability of the project, ensuring it fulfils its design purpose over at least a 120 year operational life. Many of the activities to promote the sustainable use of resources required in construction would be borne out of further detailed design decisions. Contractors would be encouraged to innovate as far as possible and be

practical in this area, ensuring that sustainability continues to be a key factor in decision making. These actions proposed would assist to meet the objective to promote the sustainable use of resources through design and construction. In operation the objective would be met as the design would require very limited resources for maintenance and servicing.

6.8 Population, human health and equality

Background

6.8.1 One of the three pillars of sustainable development relates to society. Given its scale and location, there is potential for the Thames Tideway Tunnel project to influence Londoners' health and equality, both positively and negatively. This section explores the sustainability issues surrounding population, human health and equality and identifies the specific activities and initiatives the project would undertake in contribution towards them. Further details can be found in the *HIA* and *EqIA* submitted as part of this application.

Planning policy and drivers

6.8.2 The NPS describes how adequate provision of waste water infrastructure is clearly beneficial to society and to the population's health as a whole. However, the possibility of some adverse effects during construction can be expected to arise from the construction of any new NSIP. The NPS describes how the main impacts on health may include, among other things; increased traffic, air pollution, dust and odour, and how these impacts may affect people simultaneously. The NPS also recognises how health outcomes are linked closely to other matters, such as access to jobs, open space, education and skills.

6.8.3 At the regional level the requirement to achieve healthy and sustainable communities is entrenched within policy. The *London Plan 2011* identifies that the population of London is estimated to reach over 8.82 million by 2031. With this will come both an ageing population, but also an increase in school-age leavers. Policy and government initiatives therefore need to simultaneously address the needs of an ageing population, and improve the facilities and opportunities for younger people.

6.8.4 The *London Plan 2011* describes the Mayor's vision that London becomes:

"A city that meets the challenges of economic and population growth in ways that ensure a sustainable, good and improving quality of life ... and help tackle the huge issue of deprivation and inequality among Londoners, including inequality in health outcomes".

6.8.5 Policy places clear emphasis on the benefits infrastructure can play on achieving sustainable development, which is essential to meeting the needs of modern day London. Such infrastructure should be taken forward in a way which is equitable and minimises the potential impacts on health as far as possible.

6.8.6 Thames Water is committed to health and safety and the well-being in the communities in which it operates. It holds three separate strategy areas relating to this, including:

a. Responsible operations – relating to community investment and being a good neighbour

b. Customer inclusion – relating to equality, access to services, fair charges and active engagement, and

c. Sustainable workforce – relating to employment and employability of its workforce.

The sustainability objective

6.8.7 Based on the direction of policy and taking account of Thames Water's CR&S aspirations, two sustainability objectives have been defined under this theme:

a. 'Ensure the safety and health, and support well-being of the communities in which the project operates'

b. 'Encourage equality and sustainable communities'.

6.8.8 The selection of these objectives and how these align with those selected by government in its AoS is discussed in Appendix A.7.

Sustainability appraisal

Ensure the safety and health, and support well-being of the communities in which the project operates.

6.8.9 A Health Impact Assessment (*HIA)* is submitted as part of the application, which assesses the effects of the project's construction and operational phases on the physical and mental health of the population. The *HIA* refines the understanding of health impacts identified by the government's AoS.

6.8.10 The construction of any large project in an urban environment is likely to give rise to effects from air emissions, dust, noise and vibration. These can affect local receptors. As discussed in the NPS, the adverse effects during construction on the health of the population cannot be discounted, as a result of changes in such conditions. A careful programme of management would be in place to minimise such effects where they are predicted to arise. As part of this, a comprehensive *CoCP* would be applied to control effects as far as possible both on a project-wide, and on a site by site basis. Further details are available within the *CoCP*. The assessment of impacts on human health is made within the *HIA* and within topic sections of the *Environmental Statement*.

6.8.11 Health impacts may also occur as a direct result of construction works. Thames Water is committed to health and safety, which has influenced the project's planning and design. The project will be managed through adherence to the Thames Water 'Three Zeros' policy – Zero Accidents, Zero Harm, Zero Compromise. This policy would be extended through the project's supply chain to ensure that contractors implement Thames Water's policies and values in this area.

6.8.12 Thames Water has a goal to zero incidents, by ensuring that hazards and risks are eliminated or mitigated with appropriate control measures. Thames Water recognises that as a direct impact of the construction activities the workforce would be subject to Health impacts. The project will operate an Occupational Health programme.

6.8.13 During the design process health and safety and issues have been, and will continue to be reviewed to ensure that there is either an elimination or reduction of the exposure of substances that affect a person's health and the substances used in safe application.

6.8.14 The aim of the programme is to move away from a traditional reactive and worker based approach and achieve a standard which allows the project to proactively:

a. eliminate occupational health hazards

b. limit exposure to health risk where hazard cannot be eliminated

c. ensure staff are fit for the work required of them

d. provide opportunity for workers to enhance their general health and wellbeing.

6.8.15 In operation the Thames Tideway Tunnel project would be expected to be of benefit to the physical health of the local population, especially for those utilising the River Thames recreationally. The reductions in CSO events will substantially reduce pathogens within the River Thames and the number of risk days associated with these pathogens. These changes have been determined in the *Environmental Statement*. The results demonstrate that the Thames Tideway Tunnel project would result in a substantial reduction of the risk of exposure to pathogens in those sections of the tidal Thames between Teddington and Greenwich. The reduction may be up to as much as 98% between Putney Bridge and London Bridge. Further information is available within Section 11, Volume 3 of the *Environmental Statement*.

6.8.16 The NPS also identifies how major projects may have indirect health benefits on the local population, for example by increasing employment or by promoting the use of open space and water for recreation and physical activity. The economic benefits of the project are discussed within the next section. The links between this and public health have not been directly quantified for the project, as there are a number of wider elements which can affect this, however these should be recognised.

6.8.17 In addition, the project may promote better health outcomes by:

a. creating an increase in publicly accessible open space and high quality public realm

b. upgrading existing public rights of way and the walking and cycling environment

c. ensuring that sites address principles of safety and security, including with the lighting designs specified through implementation of the design principles.

6.8.18 The AoS also recognises that links exist between health and access to education and skills. Thames Water has implemented an extensive education and community strategy in order to enhance health, especially of the younger generation who may be more sensitive to the construction effects of the project. This includes investment in the London Youth Rowing Partnership, and the STEM ambassador programme.

London Youth Rowing partnership

6.8.19 The promotion of physical activity plays an important role in the education of young people. London Youth Rowing (LYR) has been identified as the primary community investment partner for the project. Its mission is to widen access to rowing for young people from all walks of life. The key objectives of the programme are to:

a. ensure that young people most affected by construction of the Thames Tideway Tunnel project have opportunities to make greater use of recreation activities on the River Thames

b. promote inter-school sports competitions to foster community cohesion and increase coaching opportunities for teachers

c. utilise a range of mechanisms to educate young people about water and wastewater issues

d. enable project staff to make direct links with young people affected by the Thames Tideway Tunnel project through volunteering opportunities provided by LYR.

6.8.20 Thames Water is running its Row4Results indoor rowing competition in the main drive site boroughs (Hammersmith and Fulham, Wandsworth and Southwark) and also in Newham with the Lee Tunnel. Training would be provided for school staff to enable them to deliver the sessions independently. Going forward, key commitments, which will be delivered by the *Skills and employment strategy*, include:

a. engage with at least 16 schools across the project's five partner boroughs, and

b. train around 20 school staff and volunteers.

Education programme and STEM ambassadors

6.8.21 The government's AoS of the NPS for Waste Water recognises how access to employment has positive implications for the health and well-being of a population. The Engineering UK 2012 report: The State of Engineering (Engineering UK, 2012)[28], describes how science, technology, engineering and maths (STEM) skills are in strong demand. However in general there is a shortfall of skills from school leavers. In implementing an education and STEM ambassador's programme, Thames Water has the aim of encouraging an increase of people choosing to take up careers in engineering related disciplines and enthusing young people in STEM subjects at school.

6.8.22 In relation to the project, Thames Water would support STEM skills, through the following activities:

a. A range of education materials have been developed which will be delivered through online resources called Tunnelworks.

b. Thames Water would support the CREST (Creativity in Science and Technology) project awards, based on the project, for use as part of the curriculum or as enrichment activities e.g. science clubs or extended school projects.

c. Support for the STEM ambassador scheme, which enables members of the project team to volunteer in schools, for a total of 45 days per academic year to inspire young people and demonstrate the importance and opportunities that studying STEM subjects can bring.

Encourage equality and sustainable communities

6.8.23 The *UK Sustainable Development Strategy - Securing the Future* (2005) defines sustainable communities as "*places where people want to live and work, now and in the future. They meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. They are safe and inclusive, well planned, built and run, and offer equality of opportunity and good services for all*".

6.8.24 Taking the above definition it is clear that sustainable communities are complex, and influenced by a range of factors which are beyond the scope of a of a single project. In spite of this, the project does influence the development of sustainable communities and promote equality in a number of ways. Perhaps most importantly, the project would ensure that the capital's sewerage system meets the demands of 21st century London, and its predicted population growth. Without a solution there would likely be constraints on housing development which in turn could lead to a substantial impact on the economy and society.

6.8.25 The delivery of the project would also help to safeguard the future growth of London's labour markets and allow the skills legacy that have been developed from previous large infrastructure projects, such as Crossrail, to continue. Currently, the Thames Tideway Tunnel project team actively supports the Crossrail Tunnelling and Underground Construction Academy, which is training and providing employment for 70 apprenticeships a year. As the project moves into construction, specific targets would be set requiring a certain number of apprentices to be employed within the contractors' workforce.

6.8.26 Thames Water is transparent about the intention to work with its stakeholders, including the local community to ensure the maximum benefit of the project is realised. Thames Water seeks to provide opportunities for small and medium sized UK enterprises and holds an aspiration for a 20% local labour rate, especially among the drive site boroughs of Wandsworth, Hammersmith and Fulham, Southwark, the Royal Borough of Greenwich, and overall, at least 25% from directly affected boroughs.

Equality

6.8.27 Various activities have already been undertaken to promote inclusivity and equality across the project:

a. A full *Equalities Impact Assessment* (*EqIA*) has been developed for the application. The *EqIA* is designed, where possible, to promote equality for all and ensure the project does not discriminate against any individual or community.

b. The site selection process has involved consideration to community issues. Avoiding the potential for a site to disproportionately impact on an equalities group formed part of the criteria for decision making.

c. Thames Water has undertaken a rigorous consultation exercise ensuring that anyone who had an interest in, or was likely to be affected by, the construction of the Tunnel has had a chance to raise their views. The Thames Water Customer Centre offered a telephone service to translate consultation materials into any language on request.

6.8.28 Despite the project's benefits, during construction there would inevitably be impacts on local communities as a result of noise and effects on air quality. These would be limited as far as possible through extensive control measures brought forward through the *CoCP*. Furthermore, by bringing employment opportunities to some of the directly affected London Borough's, Thames Water aims to compensate for these short-term effects by creating not only jobs within the local community, but a skill legacy to enable London to deliver the increasing amount of large scale infrastructure.

6.8.29 In operation, the project would deliver improvements to the local community through an enhancement of public realm. Such examples can be seen across the project, for example at Blackfriars Bridge and foreshore, where the structure created would provide an increased provision of functional riverside amenity space, in a busy area that currently has a lack of open space. Further details are available in Appendix B.

Summary

6.8.30 The project would directly support the health and wellbeing of the population once in operation. The notable investment in the economy during construction is expected to promote health and sustainable communities indirectly, through creating jobs and improving amenity associated with the river. It is recognised that during construction, impacts on amenity might arise, however these would be local in nature and only arise during the construction process, so for the purposes of the sustainability appraisal, are regarded as short term with respect to the project lifecycle. They have also been minimised as far as possible through site selection, design proposals and a comprehensive *CoCP* which would control such effects. Once in operation, the improvements in water quality are expected to have direct health benefits for people using the river. This would be achieved through the substantial reduction in the risk of exposure to pathogens. In general the objectives are strongly supported by the proposals.

6.9 Economy

Background

6.9.1 One of the 'three pillars' of sustainable development relates to the economy. Achieving a sustainable economy is a priority area of the *UK Sustainable Development Strategy* (2005), which reflects the importance that strong economic activity plays for people's prosperity and human wellbeing.

6.9.2 London is a key driver of the UK economy, accounting for around 30% of total economic growth between 2000 and 2009[29]. It is frequently regarded as among the top cities in the world for commerce and tourism, and is an international centre for financial services. Over 4.6 million jobs were located in London in 2007 and, despite a decline during the global economic downturn; it is projected that this will increase to over 5.4 million jobs by 2031[30]. This growth is closely related to the growth in population and households (discussed in Section 6.8 above) which, when combined, will place additional pressure on existing infrastructure as more office space is developed.

6.9.3 London First highlighted that well-functioning infrastructure networks are essential to London's competitiveness and future economic growth[31]. Indeed, with "freedom from pollution" listed as an absolutely essential factor for 16% of companies considering locating to London[32] and the potential for substantial fines being levied due to non-compliance with international legal requirement , the project is considered to be essential to supporting sustainable economic growth within London[33].

Planning policy and drivers

6.9.4 The NPS sets the requirement to assess socio-economic impacts at local or regional levels during the construction and operational phases of the project. The NPS specifically highlights some of the socio-economic issues that could be considered within the assessment. Those that are particularly relevant to the sustainability of the project are:

a. regional and local job creation

b. changing influx of workers during different phases and the changes to demands on services and facilities around the area.

6.9.5 The NPS states that in making a decision, the authority should have regard to the potential impacts of the project identified by the applicant and from any other sources considered relevant and important to the decision. However, it is reasonable for the decision maker to conclude that little weight is to be given to speculative assertions of socio-economic impacts not supported by evidence (para. 4.15.10).

6.9.6 While not directly relevant for the project, the National Planning Policy Framework (NPPF) promotes sustainable economic development as a central part of the planning system. Of particular relevance, however, is its commitment to building a strong, competitive economy. It states that weight should be placed on the need to support economic growth through the planning system and that plans should proactively meet the

development needs of business to support an economy fit for the 21st century (DCLG, 2012)[34].

6.9.7 This is echoed in the *London Plan 2011* which is a key driver for sustainable development, including economic growth throughout the capital. It highlights the importance of ensuring that the necessary infrastructure is in place to *"support growth and meet the highest, and most modern standards, to help use the city's resources as sustainably and efficiently as possible"* (para 1.38). Sustainable economic development is further supported by a wide range of economic strategies at both the regional and local level, including specific policies in borough LDFs and the *Mayor's Economic Development Strategy* (GLA, 2010)[35].

6.9.8 The economic pillar of sustainability is also reflected in Thames Water's CR&S strategy. One of its nine strategy areas relates to sustainable investment. Central to this is the need to operate in a cost effective manner and provide customers with safe reliable and affordable water services now and in the future.

The sustainability objective

6.9.9 Having regard to the relevant policy context, the government's AoS and Thames Water's principles, the objective applied by the project is 'promote a strong and stable economy'. This is consistent with the objective applied in the government's AoS. Further details on the selection of the objective s provided in Appendix A.8.

Sustainability appraisal

Promote a strong and stable economy

6.9.10 The government's AoS of the NPS for Waste Water reflects the importance of sustainable growth in the regional economy and long-term investment in London. It is widely accepted that much of London's ageing infrastructure requires substantial investment to support the city's global competitiveness. Even at the height of the recession, the *Mayor of London's Economic Recovery Action Plan* recognised that investment in infrastructure was needed to avoid risking long-term damage to the prospects of the capital (GLA, 2009)[36]. The government's *National Infrastructure Plan* sets out the importance of providing the necessary infrastructure to ensure the UK maintains its economic competitiveness. It highlights that the Thames Tideway Tunnel project is a key component of infrastructure required in London (HM Treasury, 2011)[37].

6.9.11 Sustainability gives consideration to the environmental and social costs as well as purely economic factors. Estimates place the cost of the Thames Tideway Tunnel project at approximately £4.1 billion over the lifetime of the project. Defra's analysis has shown that there is likely to be an environmental benefit of between £3 billion and £5.1 billion (Defra, 2011)[38]. Furthermore, Defra's report on the costs and benefit of the Thames Tideway Tunnel project and the NPS both highlight the wider economic benefits of the project, including:

a. lower costs associated with ill health of river users

b. avoidance of damage to London's reputation as a business and tourism centre

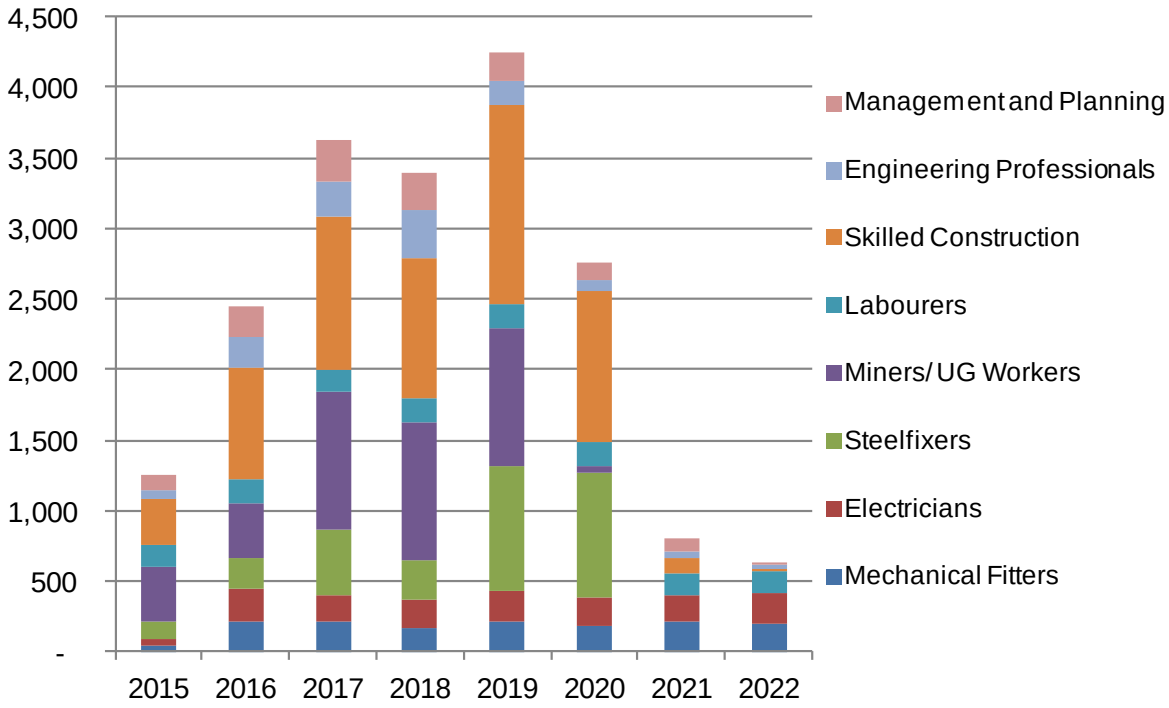
c. avoiding long-term impacts on riverside property prices

d. short-term employment, economic growth or regeneration impacts related to construction.

6.9.12 During construction, the principal effect of the project is the substantial investment into the economy and the generation of employment opportunities, which at the height of construction, would be 4,250 workers (Plate 6.9.1). The work profile and timing of the project are expected to relate well to the reduction from the most intense period of construction from the Crossrail project. As such, the Thames Tideway Tunnel project could help to provide a continuity of employment for skilled construction workers, helping to minimise any periods of potential unemployment of workers from Crossrail (Crossrail, 2010)[39].

6.9.13 The project would provide an equivalent of 19,000 employment years (which equates to 4,600 employment years per £1 billion of spend), which is comparable to other major infrastructure projects in London, such as Crossrail (Thames Water, 2012)[40].

Plate 6.9.1 The anticipated profile of direct employment project during construction



Source: Why Does London Need the Thames Tideway Tunnel? Thames Water (2012)

6.9.14 Furthermore, an additional 5,100 indirect jobs could be expected to be created as a result of the project[41]. These are likely to be in trades to support the direct construction workers, for example through increased employment further down the supply chain and in local areas where construction is taking place (such as food outlets and local shops).

6.9.15 Due to the regulated nature of Thames Water's operation, procurement legislation is in place to promote fair competition and non-discrimination. This legislation is important to ensure equal opportunities for all, although it means that specific commitments cannot be made in relation to procuring materials and services from the UK. However, when considering the Lee Tunnel, approximately 80% of expenditure on contractors and materials was through UK based firms, and it is anticipated that small and medium sized enterprises (SMEs) will be able to realise a number of business opportunities from the Thames Tideway Tunnel project as well (Thames Water, 2012)[42]. If achieved, this will have a substantial benefit on the UK economy by securing employment and stimulating economic growth. In addition, it is likely to contribute positively towards improving the UK's balance of payments (the difference between the value of goods and services, income and current transfers imported and exported), which in 2011 had a deficit of £29 billion (Office for National Statistics, 2012)[43]. Assuming 80% of the £4.1 billion cost of the project is spent in the UK, this could directly contribute £3.28 billion to the UK's current account.

6.9.16 The successful delivery of the Thames Tideway Tunnel and delivering value for money for Thames Water customers depends on a workforce with the right skills able to deliver the project. Thames Water aspires to leave a legacy of skills which may facilitate the delivery of other future infrastructure projects. In construction, the project requires a wide range of skills and therefore training requirements may vary. The Skills and Employment strategy outlines potential activities that would be developed, this includes:

a. having a minimum of 1 apprenticeship for every 50 site employees at all times

b. supporting the operation of the Tunnelling and Underground Construction Academy (TUCA) and support the development of river transport related skills through the Thames training alliance

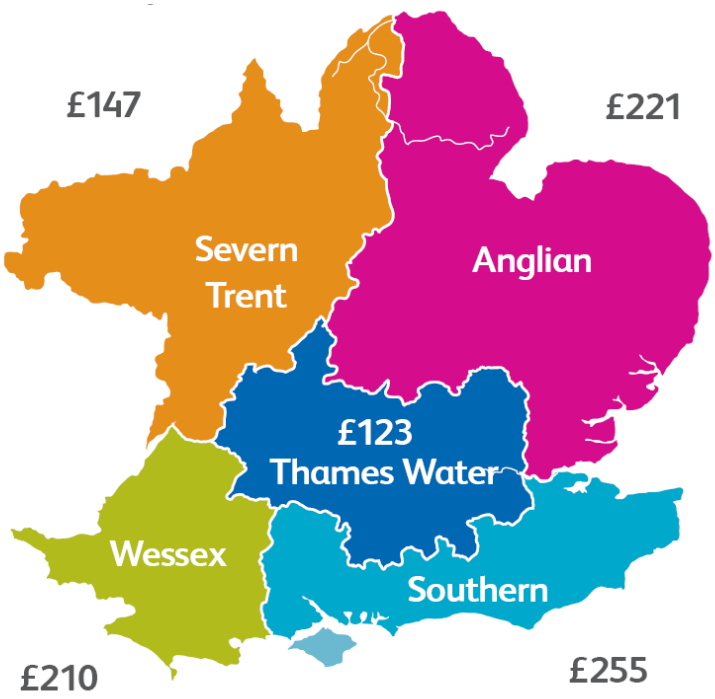
c. ensure that there are strong links continue to exist with the Lee Tunnel and Crossrail to provide effective channels for re-employment.

6.9.17 Similarly, as explained within Section 6.8, it is anticipated that the project would aim to recruit in excess of 20% of employees locally. This would positively contribute to the provision of employment opportunities and would support the local and regional economy. Recognising that a number of these will be general labourers there would be opportunities to build on the apprenticeship programme (described in Section 6.8 above) and reduce unemployment among young people.

6.9.18 One of Thames Water's CR&S strategy areas relate to customer inclusion and affordable services. It is estimated that Thames Water's customers' bills would increase by up to £80 per year to support the funding of the project. Thames Water's wastewater bills are currently the cheapest in England (in 2011/12, see Plate 6.9.2). It is estimated that up to 15% of households would spend 5% or more of their disposal income on water bills (a standard measure of affordability), however, despite the increase,

the average bill is still anticipated to be below the national average of £211 per year (Defra, 2011)[44].

Plate 6.9.2 Average wastewater charges 2011/12



6.9.19 The project would provide the necessary infrastructure to enable London to increase its housing stock and realise its population growth estimates. This is vitally important, since in doing so, it would provide a larger and more diverse labour market which can attract and support economic growth.

Summary

6.9.20 The sustainability objective to promote a strong and stable economy is clearly supported by the project, particularly over the short-term period through construction. The project is expected to generate high direct and indirect employment during this period, much of which would benefit London's economy directly. Furthermore, the project provides the opportunity to promote longer term economic opportunities, through providing a cleaner, healthier environment for business to locate and assist in unlocking future growth potential in the capital.

6.10 Environmental protection and enhancement

Background

6.10.1 The third 'pillar' of sustainable development relates to the environment. Due to the scale of the project, and the need to develop a number of different sites across London, environmental protection is an important issue for the project. An *Environmental Statement* has been submitted with the application which examines how environmental protection has been, and would continue to be addressed. This *Sustainability Statement*

does not set out to replicate details of the *Environmental Statement*, but explains how environmental protection and exploiting opportunities for enhancement, where practical and possible, has been an important factor in the sustainability of the proposals.

Planning policy and drivers

6.10.2 There is a raft of policy in place to protect and enhance the environment. The NPS requires that applicants for new NSIPs address generic impacts, common to all types of waste water infrastructure. This includes policies to control and mitigate adverse effects on air quality (Section 4.11.4), noise (Section 4.9.9), minimise harm to the landscape, (Section 4.7.6), and avoid, minimise and mitigate impacts on heritage assets, particularly significant heritage assets that may present value for current and future generations (Section 4.10.10). Regional policy is set out within the *London Plan 2011*, which includes a number of policies that seek to protect and enhance the environment.

The sustainability objectives

6.10.3 In light of the policy and the objectives held within the government's AoS, the following objectives have been defined under the theme of environmental protection and enhancement:

a. minimise significant adverse environmental effects relating to air quality, odour, noise, vibration and lighting from construction and operation of the Thames Tideway Tunnel project

b. protect and enhance the character of landscapes and townscapes

c. protect and conserve the historic environment.

6.10.4 These objectives have been grouped under the single thematic area of environmental protection and reported herein. Further details on how these align with the government's AoS is provided in Appendix A.9

Sustainability appraisal

Minimise significant adverse environmental effects relating to air quality, odour, noise, vibration and lighting from construction and operation of the Thames Tideway Tunnel project

6.10.5 At the project-wide level, the effects of the project during the construction and operation phase on air quality, odour, noise, vibration and lighting are not considered to be significant. There are, however, local effects, restricted to areas around certain sites.

6.10.6 Various measures have been implemented to ensure that nuisance and significant adverse effects have been minimised, including:

a. the site selection process has been taken forward with consideration to whether sensitive environmental receptors exist around the construction sites. This has helped to avoid impacts from arising

b. where sites have been selected that could potentially give rise to adverse effects, layout and design has been progressively amended

through design development to ensure that predicted environmental effects can be minimised

c. impacts have been assessed through the EIA process and mitigation developed and embedded within the design, to reduce environmental effects

d. a *CoCP* would be applied to reduce environmental effects from construction activities that could generate noise, air emissions and require lighting

e. a complaints process would be developed to ensure that any concerns from local residents can be handled swiftly and by dedicated teams, as opposed to a centralised call centre.

6.10.7 In operation it is not expected that significant effects would arise. The main consideration has been on odour control. The design of sites includes ventilation columns making use of carbon filters to control emissions. In certain instances, there may be an enhancement from the current situation.

Protect and enhance the character of landscapes and townscapes

6.10.8 London has an important townscape which varies across the tunnel route. The development of the project has the potential to affect the townscape at some of the sites during construction, through the use of cranes and general construction activities. Such impacts would be temporary in nature and would be felt at the site level, not at the project-wide level. Further information is available within the townscape and visual sections of the *Environmental Statement*.

6.10.9 A number of activities have been undertaken to address landscape and townscape issues, which is recognised to be a particularly important aspect for communities living around the sites. Those that relate to construction are managed through the *CoCP* and include:

a. the use of hoardings designed to reflect local requirements, such as green hoardings, which incorporate planting

b. advanced planting, helping to reduce townscape impacts during construction

c. lighting that does not intrude on adjacent buildings.

6.10.10 Thames Water has applied design principles to ensure that the permanent development works reflect local landscape and townscape issues. This includes the size and scale of permanent works and the treatment of buildings and hard landscaping.

6.10.11 The design development for sites also reflects landscape and townscape priorities. The illustrative designs have been consulted on with the local authorities, the general public and other stakeholders through a number of consultation exercises. The designs have reflected this feedback where appropriate. The designs have also been subject to independent review by Design Council Commission for Architecture and the Built Environment (CABE), and have reflected the recommendations on the advice provided. Further information is available within the *Design and Access Statement*.

Protect and conserve the historic environment

6.10.12 London's historic environment is varied, especially when considered across the entire tunnel route. It includes natural landscapes, conservation areas, heritage assets, World Heritage Sites and Scheduled Ancient Monuments.

6.10.13 At a project-wide level, during construction, no significant effects have been identified upon the historic environment. At the site level however, adverse effects could potentially arise from impacts upon prehistoric activity and post-medieval industrial archaeology along the river. Further information is available within the historic environment sections of the *Environmental Statement*.

6.10.14 There are embedded design measures within the *CoCP* and the *Design principles,* which help to minimise effects as part of the scheme which has been assessed. For example, these include:

a. provision for the contractor to prepare a heritage management plan for each project site post consent

b. protective measures, such as temporary support, hoardings, barriers, screening and buffer zones around heritage assets, and archaeological mitigation areas within and adjacent to worksites

c. modern structural and environmental design, where it interfaces with a listed building or structure, will respect the historic structural and environmental behaviour of the adjacent listed structure

d. relocation of historic materials, for the most notable elements that are removed (eg, lamp standards, lions head medallions, York stone paving) the project will reuse them in the design, where practical and appropriate

e. where trees need to be removed in a conservation area they would be replaced as close to their current positions as possible with a species that relates to the character of the area.

6.10.15 Site-specific mitigation proposed at each project site is generally considered sufficient to reduce any adverse effects which might be sustained on heritage assets; the exception to this being impacts on historic setting, particularly during construction.

6.10.16 Thames Water also aims to promote a historic environment legacy within London and would document archaeological finds through preservation by record.

Summary

6.10.17 The relationship with the project objectives is generally positive. Environmental protection measures are in built into the proposed development through an iterative design process, which began through the selection of sites for development and through the EIA process. Various other processes, such as the application of the *CoCP* would ensure that environmental impacts are controlled. Enhancements have also been identified, where possible.

6.11 Land use

Background

6.11.1 The re-use of brownfield land, and the preservation of open, greenfield space is an important element of sustainable development within London. The planning system is geared towards the protection of undeveloped sites; requiring that new development uses land as efficiently as possible. The importance of open spaces in the capital will increase as London's population grows. The sustainable use of land is therefore an important consideration for any development within the capital, including the Thames Tideway Tunnel project.

6.11.2 Due to the project's length and its linear nature (covering some 25km, across 14 local authorities), it requires a variety of worksites along the length of the river in order to facilitate construction and operation of the tunnel and intercept CSOs. Efforts have been made to identify the most appropriate sites for development. This section explains the steps taken to ensure land is used efficiently.

Planning policy and drivers

6.11.3 Sustainable land use is a key principle of the government's sustainability strategy and is echoed by a number of policies within the NPS. The importance of this objective is amplified by the shortage of green and open space within London, with some 25,000ha being classified as having deficient access to nature, that is, they are more than 1km from SINCs of at least borough importance (GLA, 2011)[45].

6.11.4 Alongside other national policies, the NPS recognises that the re-use of previously developed land can make a major contribution to sustainable development, by reducing the amount of countryside and undeveloped greenfield land that needs to be used. However, it recognises that this may not always be possible for some forms of infrastructure. The NPS highlights that assessment should be made with regard to existing land use of identified sites.

6.11.5 The *London Plan 2011* places strong emphasis on the need to preserve undeveloped sites, although it does not specifically reflect the important and over-riding need to bring forward nationally significant infrastructure, and the implications this may have on land use. The Mayor of London does however recognise the importance of re-using buildings, where practical, within the Sustainable Design and Construction SPG (GLA, 2006)[46].

The sustainability objective

6.11.6 In accordance with policy identified above, Thames Water has established the sustainability objective to ensure the 'efficient and sustainable use of land and buildings'. This has been adapted from the objective applied by government in its AoS which is to contribute to a more sustainable pattern of land use, to reflect the reuse of existing structures and the efficient use of land are important elements of sustainable development in London.

Sustainability appraisal

Efficient and sustainable use of land and buildings

6.11.7 The government's AoS of the NPS for Waste Water concluded that in relation to sustainable land use, a Thames Tunnel solution would have an uncertain effect. This was due to a lack of information about the specific sites that would be brought forward for development. The AoS did note, however, that the majority of a tunnel solution would be below ground and therefore would not directly affect surface land use (AoS Appendix E4.7.2).

6.11.8 Thames Water developed a bespoke site selection process based on multidisciplinary inputs, and was guided by the *Site selection methodology paper*. This was the subject of consultation with directly affected London local authorities and pan-London stakeholders. Overall the aim of the site selection process was not to try and identify every piece of land within a defined search area, but rather to identify realistic alternative sites that would meet the need of the project. From the beginning of the project, it was recognised that London is a dense, complex urban environment, meaning that most potential sites would be subject to some form of constraint or issues.

6.11.9 This process was used to identify worksites across three alternative route alignments. After reviewing phase one consultation feedback, it was concluded that the Abbey Mills route would be preferred. This is the shortest route (9km and 6.7km shorter than those of the River Thames and Rotherhithe routes respectively), using fewer sites, causing less disruption, and is more cost-effective. Overall, the Abbey Mills route represents a more efficient use of land.

6.11.10 The worksite identified on the Abbey Mills route were reviewed and refined by two major rounds of public consultation, interim engagement, specific targeted consultation as well as ongoing engagement with key stakeholders and local community groups. The process of assessing sites has taken into account engineering, planning, environmental, community and property considerations. The process followed and sites considered, have been recorded in detail in the *Final Report on Site Selection Process*.

6.11.11 At phase one consultation Thames Water presented a scheme with two main tunnel sites on Greenfield land, and three on brownfield sites. Following reviews of stakeholder feedback and project information, including the overall tunnelling strategy, the requirement for Greenfield sites was reduced. At phase two consultation, five main tunnel sites were proposed on previously developed land, which are associated with the largest amount of activities and land take. Also, the main tunnel drive sites, which are associated with a large volume of excavated material, are all located on the river, enabling the use of barges to reduce the impact on the highway network.

6.11.12 The CSO sites need to be as close to the sewer that is being intercepted as possible, so restricting local choice on the location in some cases. This is true for the six foreshore sites, for example at Blackfriars Bridge Foreshore site there are no alternatives. Two of the foreshore sites will

intercept multiple CSOs, making more efficient use of land. There are three greenfield CSO sites where the sewer runs under, or near these areas of open space. In each case these sites have been designed to create new areas of open space. In total, over 12,000m^2 of new open space would be created by the project.

6.11.13 Where the potential arises, selected sites make use of previously developed land, and/or existing land operated by Thames Water. There are fifteen sites located on previously developed land. For example, at Acton Storm Tanks the site combines the interception of the CSO and main tunnel reception works on one site, already operated by Thames Water. Five of the work sites are on Thames Water land where there are existing pumping stations. However, it has not always been possible to select sites on previously developed land. The River Thames is classified as 'open space', therefore work sites within the foreshore could be regarded as having an effect on this. While construction works are temporary, some permanent structures would remain. These have been designed to minimise the effect on the foreshore and the overall site footprint.

6.11.14 With regard to the re-use of buildings, there are generally limited opportunities for this across the project as whole. This is reflected by the specialist requirements of the sites. Any buildings requiring demolition to make way for the development would be subjected to pre-demolition audits, and materials recovered in accordance with Thames Water's commitments to the sustainable use of resources and raw materials (see para. 6.5.29 and Section 6.7). There proposals also retain existing pumping station buildings at Earl, Falconbrook, Greenwich, Hammersmith and Heathwall. These would be protected and retained as part of the works. In addition, the former Eastern Beam Engine House at Greenwich would be brought back into use.

Summary

6.11.15 The sustainable use of land has been an important consideration in the development of the project. The sites presented in the application are considered the most suitable package of sites that will help to meet the project objectives. The selection of sites and the proposals to operate within as small a footprint as is practical and safe, demonstrates how the sustainable use of land has been achieved. Furthermore sites that are required for construction would be reinstated, and permanent land take would be reduced from that required in construction. In general the sustainability objective is supported.

6.12 Sustainable transport

Background

6.12.1 Transport plays an important role in addressing the government's environmental, economic and social policy priorities. It can have major effects, both beneficial and adverse, on communities and the environment.

6.12.2 During its construction, the project would generate substantial quantities of excavated materials, and large volumes of materials would be brought onto the construction sites. In addition, approximately 2,300 workers would require access to the sites on a daily basis at the peak of construction. An important element of the project's planning has been to minimise the potential impacts arising from these activities on the local communities, the environment and existing transport infrastructure.

6.12.3 This section describes the approach Thames Water has taken to address transport, taking account of sustainable transport opportunities as far as practical and economic. Further details are available within the *Transport Assessment,* the transport sections within the *Environmental Statement,* the *Transport Strategy*, and the draft Project Framework Travel Plan, which are all submitted as part of the application.

Planning policy and drivers

6.12.4 Minimising transport impacts through effective planning is deemed an essential part of the government's wider policy objectives for sustainable development. The NPS for Waste Water requires that applicants for new NSIPs assess any potential transport effects, taking account of the construction, operational and decommissioning stages. The NPS sets out general guidance to reduce the effects of substantial numbers of HGV's, by favouring water-borne or rail options, over the use of road based vehicles at all stages of the project (para. 4.13.10). The project has assessed transport impacts in accordance with the NPS, although decommissioning is not included within the assessments as it is not expected that the tunnel would ever be decommissioned.

6.12.5 More broadly, the NPPF emphasises the importance of sustainable transport and encourages the reductions in greenhouse gas emissions and congestion through transport management.

6.12.6 At the regional policy level, the *London Plan 2011* and the *Mayor's Transport Strategy* (GLA, 2010)[47] both reflect national policy. The *London Freight Plan* (TFL, 2007)[48] provides guidance for sustainable freight distribution, encouraging freight to be run more efficiently, reducing unnecessary journeys, minimising journey distances and maximising loads through effective planning. The *Mayor's Air Quality Strategy* (GLA, 2010)[49] encourages the use of more sustainable transport methods to reduce PM_{10} and NO_x emissions within London. The local boroughs apply the same principles, seeking to minimise the impacts of movement of goods and waste, to minimise the potential for disturbance to local residents by encouraging the use of the River Thames and the rail network.

The sustainability objective

6.12.7 Thames Water has established the sustainability objective: 'Minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising use of sustainable transport'. This has been adapted from the government's AoS to focus more closely on the transportation of construction materials and excavated materials, which is the main focus of the project's transport

strategy. Further details on the selection of the objective is available within Appendix A.9.

Sustainability appraisal

Minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising use of sustainable transport

6.12.8 The government's AoS considers the effect of implementing the project on strategic objectives for transportation. It identified that the use of barge or rail transport would have a positive impact upon the promotion of sustainable transport, however, it also acknowledged the inevitable need to make use of road transportation for the delivery of materials, equipment and plant.

Transportation of excavated materials and waste

6.12.9 To ensure effective transport management, a *Transport Strategy* has been developed for the project which assesses different options for transporting construction and excavated material; balancing the costs and risks against the respective economic, social and environmental benefits.

6.12.10 The *Transport Strategy* holds the following objectives:

a. Minimise the potential impacts associated with the transportation of construction materials and waste excavated material on communities and the environment by prioritising movement by river, where it is judged to provide positive effects as well as being practicable and cost-effective.

b. Minimise the number and length of construction related transport movements which would be associated with the project through demand or operational management, whilst ensuring that these would not have a significant impact on congestion or economic growth.

c. Minimise the potential social and environmental impacts arising from construction-related transport associated with the project through commitments, technical specification, training and best construction and logistics practice, wherever practicable and cost effective.

6.12.11 As explored throughout this *Sustainability Statement*, the proposal to adopt the shortest tunnel route from the options considered at phase one public consultation, has a bearing on the amount of material that requires transportation. The shorter route generates less excavated material and requires fewer materials in construction, resulting in fewer HGV movements.

6.12.12 Through the site selection process, effort has been made to search for suitable main drive sites within 500m of the river. Such proximity offers increased potential to use the river during construction. As a result, it is proposed that 90% of the following materials would be transported by river:

a. main tunnel excavated material from the main tunnel drive sites at Carnwath Road Riverside, Kirtling Street, Chambers Wharf

b. import and export of cofferdam fill material at eight sites with direct river access, shaft excavated material from ten sites, and excavated material from connection tunnels, interception and associated structures at eight sites.

c. import of sand and aggregates for main tunnel secondary lining for the main tunnel drive sites at Carnwath Road Riverside, Kirtling Street and Chambers Wharf.

6.12.13 The proposals mean that approximately 53% (assuming 90% moved) of the total materials (by weight) would be transported by river. This is equivalent to preventing approximately 262,000 HGV movements occurring from the local road networks over the course of the project. While Thames Water seeks to maximise river based transport, it is imperative that flexibility is retained within the logistics strategy to use other transport modes, for example when river transport may be unavailable, and for material that is unsuitable for river transport (such as excessively wet spoil or any contaminated materials), and if major site equipment failures occur. Further details are available within the *Transport Strategy*.

6.12.14 Key commitments during the construction phase to limit impacts on the environment and communities include:

a. use of river to move 53% of materials

b. use of strategic road network, wherever possible, to minimise impacts on local highway networks

c. use of Ultra Low Sulphur Diesel in HGVs

d. marshalling around construction sites where appropriate, and driver training

e. use of delivery management systems applying ‘Just in Time’ delivery.

Construction workforce

6.12.15 The movement of personnel travelling to and from construction sites would also be required. Site parking would be limited to operational vehicles such as mini buses, management and maintenance vehicles. No other worker car parking is provided on construction sites except for at Beckton and Abbey Mills where Thames Water site parking already exists, or unless agreed with the local planning authority. The public transport accessibility of the project sites varies from having good levels of accessibility, through to having very poor levels. Travel planning initiatives have been developed and *a draft Project Framework Travel Plan* has been submitted with the application. The plan would be implemented through the CoCP, and site specific travel plans would be developed for each work site. General measures include:

a. managing access to sites by car or light vehicle using a permit system or similar approach

b. providing visitors with advance information on travel routes to the site

c. monitoring the use of on-street car parking around the site to discourage workers from parking in such locations, and working with the local authorities to deter such activity

d. promoting car sharing (for instance via the 'LiftShare' scheme) where no other sustainable transport option is practicable

e. providing information on options for a 'guaranteed lift home' service for occasions when car sharers are unable to obtain a lift home with a regular driving partner

f. providing worker transport for less accessible sites.

6.12.16 The government's AoS also considered the transport impacts associated with the tunnel in operation, identifying that the transportation of ash (assumed to arise from the incineration of sewage sludge) produced at Beckton Sewage Treatment Works (STW) to be uncertain. This is because the increase in ash produced and its effect upon traffic movements during transportation to a waste disposal site was unknown. The application for the Thames Tideway Tunnel project does not take account of the sewage management at Beckton as this has already been taken into account through the planning process when granting consent for upgrades to Beckton STW. Accordingly this has not been included within the ES. Other operational effects have been considered for routine periodic maintenance of the sites. The potential impacts here are negligible, and have not been considered to have significant effects.

Summary

6.12.17 The sustainability objective would be met by the project. The construction of the project would inevitably generate traffic. Work has been undertaken which assesses the potential for managing transport effectively, reducing its impact on communities and the environment. The project would display innovative solutions to address transport, particularly through barge utilisation, which would help to reduce road transport effects on local communities. Its application could also continue to encourage a long-term, sustainable legacy for the use of the river for transportation within London.

7 Implementing sustainability

7.1 Introduction

7.1.1 The focus of this *Sustainability Statement* has been to report the sustainability performance of the Thames Tideway Tunnel project by illustrating how the project performs against sustainability objectives, taking account of scheme information and commitments made up to the point of submission of the application. The sustainability strategy of the project will develop beyond this however. As the project moves into the next phases of development, the objectives set out within this document would be further developed and will guide Thames Water's approach.

7.1.2 Through the sustainability appraisal process it is clear that sustainability objectives defined for the project can be separated into two broad categories:

a. those where their achievement is inherent in the scheme proposals, and will be secured through the successful delivery of the project; and

b. those that can be worked towards through activities taken in further design, procurement and in construction.

7.1.3 Thames Water is in the process of developing an Integrated Management System. The system will provide a key way in which the sustainability objectives, particularly in relation to the latter above, will be planned and further developed with contractors.

7.1.4 This section provides an account of the principal mechanisms in place to implement the sustainability objectives.

7.2 Planning requirements

7.2.1 The planning process will play an important role in securing the sustainability of the project. Whilst it is not intended for there to be any specific requirements for sustainability per se, it is intended that a number of requirements will assist to deliver. The principal requirements of relevance include:

Design principles – These underpin the design of the permanent above-ground elements and spaces associated with the project. The design of sites must be brought forward to take account of these principles. They subsequently provide an important tool for carrying sustainability objectives into the final design. The design principles proposed cover a broad range of sustainability objectives and have been developed with input from the sustainability appraisal process.

Code of Construction Practice (CoCP) - The *CoCP* will be implemented and enforced through a variety of means, including through planning requirements which will form part of the Development Consent Order, and also through obligations imposed on the contractors. The *CoCP* incorporates a number of obligations on the contractor to secure

sustainability, including a series of resource management plans which have been identified as necessary through the sustainability appraisal process.

7.3 Procurement process

7.3.1 The project would be brought forward as a design and build contract, meaning that many of the detailed design decisions would be taken by the appointed contractors for the project. The procurement process would therefore be an important way in which sustainability can be embedded in the project.

7.3.2 There are a number of steps which would determine how the sustainability objectives would be secured through procurement. Consideration would be given to:

a. Which sustainability objectives can be influenced by contractors.

b. What mechanisms exist to ensure that the objectives are delivered. This might be through direct requirements on the contractors (contract terms and performance criteria), specifications (minimum standards), or through collaborative efforts, which several separate contractors might contribute towards.

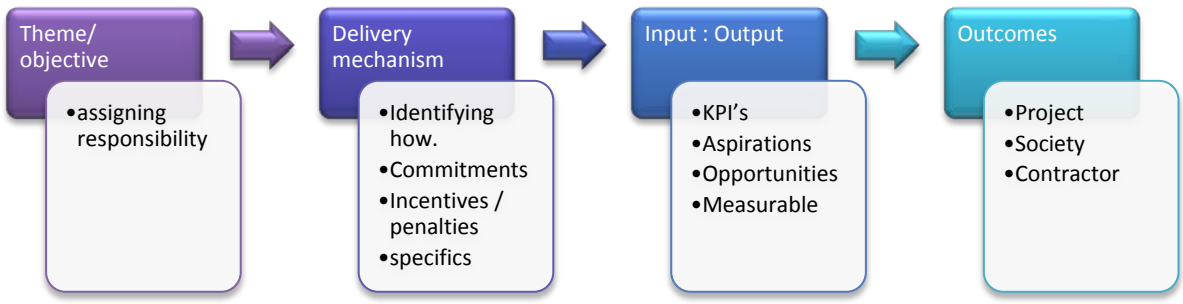
c. Identifying the weighting of different objectives.

d. Identifying ways to ensure competition is maintained between contractors and innovation encouraged, such as the use of 'stretch' targets which can be introduced in contract documents to encourage contractors to exceed performance by setting a second set of performance targets which are higher than the minimum standard.

7.3.3 In recognition that the contractors would bring significant experience in sustainable design and construction, the procurement process will aim to encourage innovation, whilst adopting best practice, rather than prescribing specific working practices.

7.3.4 The broad process is highlighted in the diagram below.

Plate 7.3.1 Procurement process



7.4 Monitoring and reporting

7.4.1 Progress towards the sustainability objectives would require that Key Performance Indicators / critical success factors to be determined. These would be used to monitor progress against the sustainability objectives. These KPIs will form the basis of internal reporting processes, but may also be used to report performance publically, for example as part of an annual performance report during construction.

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8 Overview and summary

8.1 Objectives

8.1.1 Thames Water is committed to sustainable development, which is reflected in the project's vision, which is to:

'Deliver a world class infrastructure project fit for the low carbon economy, which benefits the community, supports a healthier, cleaner River Thames and demonstrates best practice performance in sustainability across the project lifecycle'.

8.1.2 This *Sustainability Statement* summarises the findings of the sustainability appraisal undertaken for the project. Achieving a sustainable outcome for the project requires taking a balanced approach to social, economic and environmental objectives, whereby objectives for all three principle components of sustainable development can be successfully achieved. From the outset the project has been developed with regard to sustainability. This has been expressed through design development, whereby a shorter tunnel solution has been adopted, limiting the number of sites required for construction and operation, and reducing materials, energy and waste. However the sustainability benefits of the project go well beyond this. The main appraisal findings set against the themes and objectives are shown below, demonstrating how a sustainable outcome would be achieved by the project.

Water quality: Maintain and enhance river water quality.

8.1.3 The Thames Tideway Tunnel project would facilitate improvements to water quality of the tidal Thames. The project would secure compliance with the requirements of the Urban Waste Water Treatment Directive (UWWTD) and help to achieve compliance with the Water Framework Directive (WFD). It would also result in the tidal Thames meeting the dissolved oxygen standards set by the *Thames Tunnel Strategic Study* and adopted by the Environment Agency (EA). It will serve to enhance water quality in the tidal Thames through the capture of approximately 96% of combined sewage and the reduction of discharges (from over 50 per year to 4 or less).

Biodiversity: Maintain and enhance biodiversity.

8.1.4 The project has the potential to deliver significant benefits to London's wildlife. Improvements in water quality could provide conditions which are conducive to enabling a number of pollution sensitive species to recolonise the tidal Thames, which over the long-term could provide a legacy of benefits for biodiversity. There are also opportunities to maintain and enhance permanent development sites to benefit local ecology.

Climate change mitigation: Maximise energy efficiency and minimise the carbon footprint of the project.

8.1.5 The project would generate greenhouse gas emissions. These would arise from construction activities, and also indirectly from the production of construction materials, particularly from concrete and steel production.

Much of this is inevitable when creating a durable tunnel, designed to operate for at least 120 years. Steps have been taken to maximise energy efficiency and minimise the carbon footprint of the project.

Change adaptation and flood risk: Maximise resilience and adaptability to change, and take account of flood risk in the design of sites.

8.1.6 The project would address the frequent discharge of combined sewage into the tidal Thames. For the project to be sustainable, it must be resilient to future change, including an increase in population and a changing climate. The system design draws from future climate change projections and population trends, and can meet these challenges with limited adaptation measures, whilst continuing to meet the projects CSO management objectives.

Excavated material and waste management: Minimise waste arisings and its impacts on the environment and communities and to drive promote re-use, recovery, recycling and beneficial use.

8.1.7 Over the course of the project over 4.7 million tonnes of material would be excavated from shafts and tunnels. These materials would be managed in accordance with sustainable waste management practices, ensuring that the potential for waste is minimised as far as practical and possible, and opportunities to use it beneficially are promoted.

Resources and raw materials: Promote the sustainable use of resources.

8.1.8 The project would require over 1.5 million tonnes of concrete, grout and steel during construction of the tunnels and shafts. Being resource efficient is an important aim for the project, however its sustainability is dependent on its ability to be durable, and continue to function for its 120 year design life. The sustainable use of resources has been promoted through tunnel route optimisation, including the tunnel length being reduced during design development and the reduction in interception shafts required. Activities to promote the sustainable use of resources would continue through the detailed design and construction stages.

Population, human health and equality: Ensure the safety and health, and support well-being of communities in which the project operates and to encourage equality and sustainable communities.

8.1.9 The tunnel's route, covering 14 local planning authorities, passes through a diverse range of communities, including some of the most deprived areas within London. The project team has developed proactive initiatives to ensure that communities have been consulted, and benefit from the proposals. The consultation exercise has included equality by making project information available in a wide range of formats and languages. Health benefits associated with the project would also be realised through the control of CSO discharge.

Economy: Promote a strong and stable economy.

8.1.10 Thames Water would implement a number of initiatives that would help maximise the economic benefits of the project. The project would support a strong and stable economy through the provision of good quality

infrastructure and the creation of over 9000 jobs during the construction process. Wider benefits are expected to arise, post construction from skills development and retained infrastructure, which would leave a legacy for London's river users (commercial, community and pleasures).

Environmental protection and enhancement: Minimise significant adverse environmental effects relating to air quality, odour, noise and vibration, and lighting from construction and operation of the Thames Tideway Tunnel protect and enhance the character of landscapes and townscapes; protect and conserve the historic environment.

8.1.11 Potential environmental effects arising from construction have been limited as far as possible through site selection, the EIA process and design development, albeit some effects are likely to still remain during construction and operation. The *Environmental Statement* details the assessment of the likely significant effects of the project at each site and on a project-wide basis. The effects would be minimised by the *CoCP*. Opportunities for enhancement would continue to be explored where practical and possible.

Land use: Efficient and sustainable use of land and buildings.

8.1.12 The sites required for construction and operation of the project have been brought forward through a site selection process, which has considered planning, property, environment, engineering and community aspects resulting in the most suitable sites being selected for use. The *Final Report on Site Selection process* explains how this has been successfully achieved. Designs have been optimised to make the most efficient and effective use of land, and re-use buildings where practical.

Sustainable transport: Minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising the use of sustainable transport.

8.1.13 The transportation of excavated materials, waste and construction materials would be managed to minimise impacts on communities and the environment. A number of initiatives have been developed for the project, in particular the adoption of river transportation for the removal of excavated material and delivery of certain bulk materials to help reduce the effects associated with road transport.

8.2 Conclusion

8.2.1 In summary the Thames Tideway Tunnel project will be taken forward with full regard to sustainable development. It would make an important contribution to London's physical environment, whilst also promoting social and economic benefits – addressing and balancing the three pillars that make up sustainable development.

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Glossary

Term	Description
Aggregates	The mineral materials, such as sand or stone, used in making concrete.
Benchmarking	Benchmarking is the process of comparing one's business processes and performance metrics to industry bests and/or best practices from other industries.
Best practice	A method or technique that has consistently shown results superior to those achieved with other means, and that is used as a benchmark.
Blue Ribbon Network	The Blue Ribbon Network includes the Thames, the canal network, the other tributaries, rivers and streams within London and London's open water spaces such as docks, reservoirs and lakes. It includes culverted (or covered over) parts of rivers, canals or streams.
BREEAM	BREEAM sets the standard for best practice in sustainable building design, construction and operation and has become one of the most comprehensive and widely recognised measures of a building's environmental performance. A BREEAM assessment uses recognised measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use.
Carbon footprint	A 'carbon footprint' measures the total greenhouse gas emissions caused directly and indirectly by a person, organisation, event or product.
Carbon neutral	Carbon neutral means that – through a transparent process of calculating emissions, reducing those emissions and offsetting residual emissions – net carbon emissions equal zero'.
CEEQUAL	CEEQUAL is the UK's assessment and awards scheme for improving sustainability in civil engineering and the public realm. It aims to deliver improved project specification, design and construction and to demonstrate the commitment of the civil engineering industry to environmental quality and social performance.

Term	Description
Climate change adaptation	Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.
Climate change mitigation	In the context of climate change, a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to solar energy or wind power, improving the insulation of buildings, and expanding forests and other 'sinks' to remove greater amounts of carbon dioxide from the atmosphere.
CoCP: Code of Construction Practice	The *CoCP* sets out the standards and procedures to which a contractor must adhere to when undertaking construction on the project thus managing the environmental effects. It also identifies the main responsibilities and requirements of Contractors during construction.
Combined sewer overflow (CSO)	A structure, or series of structures, designed to allow discharge of excess wastewater from a combined sewer under high rainfall conditions. Flows may discharge by gravity or by pumping.
Considerate Constructors Scheme	The Considerate Constructors Scheme is the national initiative, set up by the construction industry, to improve its image.
Contaminated land	Land which present an unacceptable risk to human health or the environment.
Cut/fill balance	The cut/fill balance refers to the volume of excavated materials compared with the volume of materials needed for filling.
Environmental Management System	An Environmental Management System (EMS) is a structured framework for managing an organisation's significant environmental impacts.
Energy hierarchy	The energy hierarchy prioritises the methods for reducing GHG emissions associated with energy use. Reduction efforts should firstly concentrate on energy conservation methods, than on energy efficiency methods and finally on the generation and utilisation of renewable energy.
Equalities Impact Assessment (EqIA)	*Equality Impact Assessment* (*EqIAs*) is a tool, which enables the implications of planning decisions on communities to be assessed.
Flood risk	The statistical probability of a flood event occurring

Term	Description
	combined with the scale of the potential consequences of that flood event.
Freight Operator Recognition Scheme (FORS)	The Freight Operator Recognition Scheme (FORS) is a membership scheme that aims to improve freight delivery in London.
Forestry Stewardship Council (FSC)	FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests and certify that timber is sourced from sustainable sources.
Good ecological status	Good ecological status is defined in Annex V of the Water Framework Proposal, in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics.
Green BELT	Land, often around urban areas, that is protected against development in planning policy.
Green Guide To Specification	The Green Guide to Specification is a tool published by the BRE, which provides designers and their clients with guidance on the environmental impacts of a large number of building elements including roofs, walls, etc.
Green infrastructure	Green Infrastructure (GI) is a strategically planned and delivered network of high quality green spaces and other environmental features.
Brown roofs	A brown roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane.
Framework Travel Plan	A travel plan is a strategy for managing all travel and transport within an organisation, principally to increase choice and reduce reliance on the car by seeking to improve access to a site or development by sustainable modes of transport. A travel plan contains both physical and behavioural measures to increase travel choices and reduce reliance on single-occupancy car travel.
Greenfield	Greenfield land is land which has not previously been developed and is unmanged or used for the purposed of agriculture .
Ground granulated blast furnace slag (GGBS),	GGBS obtained from quenching molten iron slag (a by product of the steel and iron making process) to produce a glassy, granular surface, which is then dried and ground into a fine powder. It can be used in combination with portland cement to create concrete structures.

Term	Description
Hazardous waste	Hazardous waste is waste is included in the list compiled by the European Commission as Annexes I and II of the Hazardous Waste Directive, and which displays one or more of the hazardous properties set out in the Annex III of that Directive.
Landscape and Habitat Management Plan	A plan which sets specific, measurable, achievable, realistic and time bound conservation targets for species and habitats.
Non hazardous waste	Waste which is neither inert nor classed as Special and does not fall within the hazardous waste classification.
Non-potable water	Water that is not of drinking water quality.
PAS 100 compost	The standard developed by WRAP, which covers the manufacture of compost and ensures it is safe and reliable.
Permeable paving	Permeable paving covers a range of materials and techniques for applying to roads, cycle paths, parking lots etc, which allows the passage of air and water through the paving.
Potable water	Water fit for human consumption.
Pulverised fuel ash (PFA),	Pulverised Fly Ash is the ash resulting from the burning of pulverised coal in coal-fired electricity power stations.
Rainwater harvesting	Rainwater harvesting is the accumulating and storing, of rainwater for reuse, before it reaches the aquifer.
Resource Management Plans	A tool designed by WRAP and the London Olympics for event organisers, venues and suppliers to create action plans for managing and reducing event waste.
Urban heat island effect	The buildings, concrete, asphalt, and the human and industrial activity of urban areas have caused cities to maintain higher temperatures than their surrounding countryside. This increased heat is known as an urban heat island.
Virgin materials	Resources extracted from nature in their raw form, such as timber or metal ore.
Waste arisings	Waste resulting form the excavation process.
Waste hierarchy	The revised Waste Framework Directive introduced a changed hierarchy of options for managing wastes. It gives top priority to preventing waste in the first place. When waste is created, it gives priority to preparing it for re-use, then recycling, then other recovery such as energy recovery, and last of all disposal (for example landfill).
Water quality	Water quality refers to the physical, chemical, biological and organoleptic (taste-related) properties of water.

Term	Description
Water scarcity	The point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully.
Whole life cost	The total cost of a building or its parts throughout its life, including the costs of planning, design, acquisition, operations, maintenance and disposal, less any residual value, in terms of carbon emissions.

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