Thames Tideway Tunnel
Thames Water Utilities Limited

Development Consent Order

Application Reference Number: WWO10001

Documents for Certification
September 2014

We, Lindsay Speed and Sarah Fairbrother hereby certify that this is a true copy of the environmental statement referred to in Article 61 (1) (f) of the Thames Water Utilities Limited (Thames Tideway Tunnel) Order 2014.

Lindsay Speed

Sarah Fairbrother

September 2014

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

Thames Tideway Tunnel
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Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.01**

Volume 1: Introduction to the Environmental Statement

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

Hard copy available in

Box **15** Folder **A**
January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 1: Introduction to the Environmental Statement

Errata

Section	Paragraph No.	Page No.	Errata / Clarification
All	N/A	N/A	Any references to the Development Consent Order being granted by the Planning Inspectorate or the Secretary of State should be read as being granted by government ministers.
All	N/A	N/A	Any references to the Thames Tideway Tunnel noise insulation and temporary re-housing policy are included in the compensation programme which is provided in Volume 1 Appendix C of the *Environmental Statement*, as well as in Schedule 2 of the *Statement of Reasons,* which accompanies the application. Information provided in Schedule 2 of the *Statement of Reasons* can therefore also be obtained from Volume 1 Appendix C.

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Environmental Statement

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Application for Development Consent

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Volume 1: Introduction to the Environmental Statement

Introduction

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1 Introduction

1.1 Introduction to the project

1.1.1 This *Environmental Statement* has been prepared by Thames Water Utilities Limited[i] (Thames Water) to accompany the application for development consent ('the application') for the Thames Tideway Tunnel project ('the project'). It has been prepared pursuant to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the 2009 EIA Regulations).

1.1.2 The project comprises a wastewater storage[ii] and transfer tunnel between Thames Water's operational sites at Acton Storm Tanks and Abbey Mills Pumping Station. The tunnel would intercept identified combined sewer overflows (CSOs) that frequently discharge into the tidal reaches of the River Thames. The flows of combined sewage (raw sewage mixed with rainwater) discharged from those CSOs would be captured, stored and pumped out for treatment at Beckon Sewage Treatment Works. A total of 24 sites in London are required to construct and operate the project. A summary overview description of the project is set out in Section 2 of this *Environment Statement*. Detailed descriptions of the project that has been assessed are provided in Volume 3 (Project-wide effects assessment) and the site assessment volumes (Volume 4 to 27).

1.1.3 By virtue of its location, purpose and storage capacity, the project constitutes a Nationally Significant Infrastructure Project (NSIP), under Sections 14(1)(o) and 29(1A) of the Planning Act 2008 (the '2008 Act').

1.1.4 In accordance with the 2008 Act, Thames Water is making an application for development consent seeking the consent and powers necessary for the construction, operation and maintenance of the project. The project has evolved through a robust site selection process, in response to extensive consultation and engagement with stakeholders, and through on-going design development.

1.1.5 The National Policy Statement for Waste Water (designated March 2012) (the 'NPS') sets out government policy for planning decisions on NSIPs for this type of infrastructure. The NPS confirms the Thames Tideway Tunnel as the preferred solution to address the problem of discharges of untreated sewage from CSOs into the tidal Thames. The need for the project is explained below (paras. 1.1.8 to 1.1.71). Section 1.3 includes a detailed description of the NPS policies relevant to the *Environmental Statement*.

1.1.6 As set out in para. 1.1.1 of the NPS, the Planning Inspectorate and the decision maker (the relevant Government ministers) will use the NPS as the primary basis for deciding the application. Sections 3.2 and 4 of the

[i] The *Draft Development Consent Order (DCO)* contains an ability for Thames Water to transfer powers to an Infrastructure Provider (as defined in article 2(1) of the DCO) and/or, with the consent of the Secretary of State, another body

[ii] It should be noted that wastewater would only be stored in the tunnel for a temporary period until it can be pumped out at Beckton Sewage Treatment Works

NPS have specific relevance to the *Environmental Statement*. In making its decision, the decision maker must also have regard to any local impact report submitted by a relevant local authority, any relevant matters prescribed in regulations, any Marine Policy Statement (MPS) and any other matters which it considers are both important and relevant to its decision.

The applicant

1.1.7 Thames Water is a statutory water and sewerage undertaker. It is the United Kingdom's largest water and wastewater services company, serving around 13 million customers across London and the South East of England. It has a statutory duty under the Water Industry Act 1991 to provide, improve and extend a system of public sewers and effectually deal with the contents of those sewers. This duty is enforceable by the Secretary of State for Environment, Food and Rural Affairs and the Water Services Regulation Authority (Ofwat).

The need for the project

Introduction

1.1.8 London's sewer system was designed in the 1800s to handle wastewater and run-off rainwater through a combined collecting system. CSOs were incorporated into the sewer system as relief structures to prevent flooding caused by sewer overloading, especially during periods of heavy rainfall.

1.1.9 Much of London's sewerage infrastructure consists of combined systems, where a single set of sewers convey both foul sewage and rainwater run-off to a sewage treatment works. The current sewer system is subject to significant flows from surface drainage and therefore generates large volumes of combined sewage (sewage mixed with rainwater). Rainfall causes combined sewer systems to surcharge quickly. For this reason, it is normal practice to incorporate overflows that allow excess flows to discharge directly into a watercourse to reduce flood risk to properties and prevent the sewerage system overloading.

1.1.10 The capacities originally allowed for in the interceptor sewer systems originally designed by Sir Joseph Bazalgette in the 1850s have been extended and are now regularly exceeded. This is largely due to increases in population and water usage. Areas of hardstanding have also increased. For example, the population of Inner London in 1851 was 2,652,000[iii], the current population of the Beckton and Crossness catchments is 5,242,000 and this is forecast to increase to 6,222,000 in the 2020s. Increased areas of hardstanding have reduced the capability of the land to absorb rainwater, which instead now enters the sewerage network. It now takes as little as a few millimetres of rainfall to cause some CSOs to discharge combined sewage into the tidal Thames.

1.1.11 In the summer of 2010, Thames Water published a detailed *Needs Report*, which accompanies the application. This section does not seek to repeat that report, but does update it to reflect developments since its publication,

[iii] See appendix C to the *Needs Report*.

such as the designation of the National Policy Statement for Waste Water and the delivery of the judgement by the European Court of Justice in the Infraction Proceedings.

1.1.12 One section of the *Needs Report* that requires an update is Section 3.5.2, which refers to the provisions of the Water Resources Act 1991 concerning the offence of pollution of controlled waters. These provisions have now been replaced by the Environmental Permitting (England and Wales) Regulations 2010, which came into force during 2010.

1.1.13 The National Policy Statement for Waste Water (the 'NPS') was formally designated on 26 March 2012 by the Secretary of State for Environment, Food and Rural Affairs following a debate in the House of Commons on 19 March 2012.

1.1.14 The NPS establishes the need for a Thames Tunnel[iv]. Para. 2.6.34 clearly states that: *"The examining authority and the decision maker should undertake any assessment of an application for the development of the Thames Tunnel of the basis that the national need for this infrastructure has been demonstrated. The appropriate strategic alternatives to a tunnel have been considered and it has been concluded that it is the only option to address the problem of discharging unacceptable levels of untreated sewage into the River Thames within a reasonable time at reasonable cost"*.

1.1.15 The NPS sets out (para. 2.6.16) the drivers of demand for the Thames Tideway Tunnel project (the 'project'). It sets out the problems and explains that London's combined sewer overflows (CSOs) overflow into the tidal reaches of the River Thames approximately 50 times per year and affect:

a. biodiversity by reducing dissolved oxygen levels in the river potentially resulting the death of adult fish and fish fry

b. health by increasing pathogenic bacteria, which potentially pose risks to river users

c. the attractiveness of the environment due to large quantities of offensive solid material being discharged into the tidal Thames and deposited on the foreshore.

1.1.16 The NPS clearly states that a collecting system and treatment to meet the requirements of the Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC) is required for the London agglomeration by 31 December 2000. At para. 2.6.20 of the NPS, the requirements of the Directive are summarised as requiring *"that sewage (domestic, industrial and rainwater run-off) is collected and conveyed to plants for secondary treatment, overflows are reduced and measures taken to limit pollution of the tidal Thames"*.

1.1.17 Other drivers include the Water Framework Directive, climate change and population growth. The NPS clearly states (para. 2.6.21) that the UWWTD is the *"initial driver"* for the project and that full implementation of this

[iv] The project changed its name from the Thames Tunnel project to the Thames Tideway Tunnel project in July 2012.

Directive is a basic (obligatory) measure in the Water Framework Directive.

1.1.18 The consideration of alternatives to a storage and transfer tunnel is outlined at paragraphs. 2.6.26 to 2.6.30 of the NPS. It recognises that, as does Thames Water, Sustainable Drainage Systems can play a key role in increasing the capacity and resilience of London's sewer network by reducing the volume of flows entering sewers. However, it also notes that the simultaneous retrofit of all London's properties and sewerage systems to the required level would be disproportionately expensive and that it has not been demonstrated that this would sufficiently reduce combined sewage discharges. More detailed work in this regard can be found in the *Thames Tideway Strategic Study* (*TTSS*) and at Appendix E of the *Needs Report*.

1.1.19 Other alternatives considered included creating additional capacity within the sewerage system and converting the combined drainage system to a separate drainage system. As set out in paragraphs. 2.6.26 to 2.6.31 of the NPS, these alternatives were rejected on the grounds of the very high cost and level of disruption to London.

1.1.20 The NPS also states (paragraphs. 2.6.26) that a non-intervention, or 'do nothing' strategy is not considered feasible due to the frequency and volume of discharges and their consequent environmental impacts.

1.1.21 Therefore, as stated in paragraph. 3.4.1 of the NPS *"these strategic alternatives do not need to be assessed by the examining authority or the decision maker".*

1.1.22 Following the adoption of the European Union's Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, it became a statutory requirement to undertake a Strategic Environmental Assessment (SEA). The objective of the SEA Directive is *"to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to contributing to sustainable development".*

1.1.23 Section 5(3) of the Planning Act 2008 requires that, before designating a National Policy Statement, the Secretary of State must carry out an Appraisal of Sustainability (AoS) of that policy. The AoS carried out for the NPS incorporates an SEA and meets the requirements of the SEA Directive. The recommendations of the AoS influenced the final NPS. It is available on the website of the Department for Environment, Food and Rural Affairs (Defra). The 'plan or programme' for the project is the NPS. An SEA was therefore carried out in relation to the project by the appropriate body.

1.1.24 The AoS should be read alongside the *AoS Post Adoption Statement* (March 2012), which is a further requirement of the SEA Directive (the *Post Adoption Statement* is also available on Defra's website). The statement concluded that: *"Resolving the issue of frequent spills of untreated wastewater containing sewage into the tidal reaches of the River Thames has been subject to extensive and comprehensive studies,*

including consideration of a wide range of alternative solutions, for more than a decade. As a result of which the Government is satisfied that the development of the Thames Tunnel is the most cost effective and timely solution to address the problem of untreated sewage is [sic] discharging into the River Thames as demonstrated in the Waste Water National Policy Statement" (para. 5.5.9).

1.1.25 The NPS is also clear, particularly in the Annex, as to the nature of the Thames Tideway Tunnel necessary in order to meet the identified need. Para. A1.3.2 states that the tunnel is *"likely to run for approximately 25km from West to East London to intercept storm sewage overflows and transfer them for treatment at Beckton sewage treatment works (STW) in East London. A major part of the tunnel route is likely to follow the course of the River Thames".* Similar text is also set out at para. 2.6.25.

1.1.26 Para. A1.3.10 of the NPS notes that although the exact location of the tunnel and associated shafts has not yet been confirmed, the proposed scheme would span up to 14 London Boroughs, which it lists by name. The boroughs broadly span from Richmond upon Thames to Newham.

1.1.27 Para. 2.6.34 states that Thames Water must justify the specific design and route of the project in its application for development consent. The *Planning Statement*, the *Design and Access Statement* and the *Final Report on Site Selection Process*, which accompany the application, were prepared for that purpose.

1.1.28 The NPS states that the Environment Agency has a particular role to play in defining the nature of the required project in more detail. In order to inform water companies' spending plans, the Environment Agency proposes various projects for inclusion in the National Environment Programme (NEP) that are needed to meet statutory environmental requirements. The Environment Agency works to ensure that every environmental improvement included in the NEP is necessary, addresses a known problem, and is based on evidence that action is required. The Environment Agency expects water companies to include 100 per cent of the NEP in their final business plans.

1.1.29 Paragraph 2.5.2 of the NPS states that the NEP must be included in any water or sewerage company business plan submitted to the Water Services Regulation Authority (Ofwat). Ofwat is responsible for scrutinising the overall plan and the associated costings. Paragraph 2.5.3 indicates that: *"The Government therefore considered that the need for new waste water treatment infrastructure will have been demonstrated if the Environment Agency has concluded that the project is necessary for environmental reasons and included it in its National Environment Programme"*.

1.1.30 The project is included in the current NEP and it is anticipated that this will be confirmed by the Environment Agency in its Statement of Common Ground.

Requirements of the Urban Waste Water Treatment Directive

1.1.31 The UWWTD concerns the collection, treatment and discharge of urban wastewater and the treatment and discharge of wastewater from certain

industrial sectors. Article 1 states that: *"The objective of the Directive is to protect the environment from the adverse effects of the above mentioned waste water discharges".*

1.1.32 Article 2 sets out the definitions of various terms. The term 'urban waste water' is defined as *"domestic waste water or a mixture of domestic waste water with industrial waste and/or run-off rainwater"*. A 'collecting system' is defined as *"a system of conduits which collects and conducts urban waste water*". 'Secondary treatment' is defined as *"treatment of urban waste water by a process generally involving biological treatment with a secondary settlement or other process in which the requirements established in Table 1 of Annex 1 are respected*".

1.1.33 Article 3(1) provides that*: "Member States shall ensure that all agglomerations are provided with collecting systems for urban waste water"*. For an agglomeration over 15,000, such a system is to be in place by 31 December 2000, although the earlier date of 31 December 1998 applies where the discharge is into 'sensitive areas' as defined in the UWWTD.

1.1.34 Article 3(2) states that the 'collecting systems' described in Article 3(1) must satisfy the requirements of Annex 1(A) to the Directive. Annex 1(A) provides that:

"Collecting systems shall take into account waste water treatment requirements. The design, construction and maintenance of collecting systems shall be undertaken in accordance with the best technical knowledge not entailing excessive costs, notably regarding

a. "volume and characteristics of urban waste water,

b. "prevention of leaks,

c. "limitation of pollution of receiving waters due to storm water overflows".

1.1.35 The footnote to Annex 1(A) provides: *"Given that it is not possible in practice to construct collecting systems and treatment plants in a way such that all waste water can be treated during situations such as unusually heavy rainfall, Member States shall decide on measures to limit pollution from storm water overflows. Such measures could be based on dilution rates or capacity in relation to dry weather flow, or could specify a certain acceptable number of overflows per year".*

1.1.36 Article 4(1) provides that: *"Member States shall ensure that urban waste water entering collecting systems shall before discharge be subject to secondary treatment or an equivalent treatment".*

1.1.37 This is to be achieved by the dates specified, depending on the size of the agglomeration. Article 4(3) then relates Article 4(1) to the requirements of Annex 1 as follows:

"Discharges from urban waste water treatment plants described in paragraphs 1 and 2 shall satisfy the relevant requirements of section B of Annex 1I".

1.1.38 The requirements of Annex 1(B) include that:

"2. Discharges from urban waste water treatment plants subject to treatment in accordance with Articles 4 and 5 shall meet the requirements shown in Table 1".

1.1.39 Table 1 sets out certain technical requirements for discharges from wastewater treatment plants. Annex 1(B) para. 3 also makes provision for discharges into 'sensitive areas' by reference to Table 2.

1.1.40 Article 10 of the Directive states that:

"Member States shall ensure that the urban waste water treatment plants built to comply with the requirements of Articles 4, 5, 6, and 7 are designed, constructed, operated and maintained to ensure sufficient performance under all normal local climatic conditions. When designing the plants, seasonal variations of the load shall be taken into account".

Infraction proceedings against the UK Government

1.1.41 As set out above, the UWWTD is identified in the NPS as the initial legislative driver for the project. The UK was required to be in compliance with the directive by 31 December 2000. On 18 October 2012 the European Court of Justice handed down a judgement in the case of proceedings brought by the European Commission, which determined that having failed to control discharges in the Beckton and Crossness catchments, the UK Government is in breach of the Directive.

1.1.42 The Court noted that it was not in dispute that the collection system was not in compliance with the directive. It noted that a project is underway for the construction of a new tunnel under the River Thames to intercept discharges and convey them to Beckton (ie the Thames Tideway Tunnel). It also noted that the costs of the project cannot be disproportionate since in April 2007 the UK Government decided to proceed with the works identified in the *TTSS* report (November 2005), including the construction of a new wastewater transfer and storage tunnel. The court found that the UK has failed to fulfil its obligations under the UWWTD.

Thames Tideway Strategic Study

1.1.43 The TTSS was set up in 2001 (although preliminary organisational work was undertaken in 2000) and reported in February and November 2005. The steering group was established under the independent chairmanship of Professor Chris Binnie. Its members included representatives from Thames Water, the Environment Agency, Defra, the Greater London Authority and Ofwat (as an observer).

1.1.44 The purpose of the TTSS was to assess *"the environmental impact of intermittent discharges of storm sewage on the Thames Tideway, to identify objectives for improvement and to propose potential solutions, having regard to costs and benefits"*. It is important to note that the steering group was established several years before any complaint was made to the European Commission. It was not set up to respond to complaints to the commission; it reflected already existing concerns in relation to the environmental effects of sewage discharges into the tidal Thames.

1.1.45 As part of the study, the Environment Agency categorised the 57 CSOs from the Beckton and Crossness catchments according to their environmental impact and frequency of operation. The Environment Agency considered the volume and frequency of the discharges, and assessed their impact on river water quality and ecology. The CSOs were then divided into four categories according to criteria, including frequency and volume of discharge, as follows:

a. Category 1: discharges that have an adverse environmental effect and occur frequently during periods of rainfall which cannot be defined as unusually heavy.

b. Category 2: discharges that have an adverse environmental effect but only operate infrequently, during periods of heavy rainfall.

c. Category 3: discharges that do not have any significant environmental effect.

d. Category 4: discharges that occur at a similar frequency to Category 1, but have been assessed as not causing a significant adverse environmental impact.

1.1.46 In total, 25 CSOs were identified as Category 1, 11 as Category 2, 18 as Category 3 and three as Category 4. The CSOs in categories 1 and 2 are required to be controlled by either the Lee Tunnel Project or the Thames Tideway Tunnel project. Category 3 and 4 CSOs do not require any action.

1.1.47 A total of 36 CSOs were identified as 'unsatisfactory' and requiring attention, of which 34 discharge into the tidal Thames and two into the River Lee. The Environment Agency has reviewed this work a number of times since 2005 and has on each occasion confirmed that all 34 Category 1 and 2 CSOs that discharge into the tidal Thames need to be controlled by the project.

1.1.48 The Abbey Mills Pumping Station CSO's discharges (Category 1) will be addressed by the Lee Tunnel Project and discharges from the Wick Lane CSO by a standalone project.

1.1.49 The *TTSS* developed specific environmental objectives, which the project needs to address in order to reduce:

a. the adverse environmental impacts on river ecosystems and on fish species in particular

b. the unacceptable aesthetic issues

c. the elevated health risks for recreational users of the tidal Thames.

1.1.50 The *TTSS* established that these environmental objectives can only be met at least cost by carrying out quality improvements to the sewage treatment works and intercepting unsatisfactory CSOs and diverting flows into a storage and transfer tunnel.

1.1.51 Ofwat then commissioned Jacobs Babtie to review the *TTSS*. The principal output of this review was an alternative solution, based on two shorter tunnels (one in West London and one in East London), along with further recommendations (Jacobs Babtie, 2006)[1]. Defra considered the

various recommendations and asked Thames Water to provide cost information on the identified tunnel solutions.

1.1.52 Defra then considered the *TTSS* and subsequent studies, including the Jacobs Babtie report, and issued a Regulatory Impact Assessment in March 2007. The Regulatory Impact Assessment specifically rejected the Jacobs Babtie solution as it did not meet the required regulatory or *TTSS* environmental objectives.

1.1.53 Ian Pearson, the then Minister of State for Climate Change and the Environment, in a letter to the Chief Executive Officer of Thames Water dated 17 April 2007, stated that:

"a full-length storage tunnel with additional secondary treatment at Beckton sewage treatment works – is needed. This is both to provide London with a river fit for the 21st century, and for the UK to comply with the requirements of the Urban Waste Water Treatment Directive concerning provision of collecting systems and, in particular, limitation of pollution from storm water overflows".

1.1.54 Furthermore, Ian Pearson subsequently requested that Thames Water *"make provision for the design, construction, and maintenance of a scheme for the collecting systems connected to Beckton and Crossness sewage treatment works which involves a full-length storage tunnel with additional secondary treatment at Beckton sewage treatment works"*.

1.1.55 It is important to note that the correspondence also stated:

"*This letter does not amount to enforcement action which would require a precise enforcement order or set of undertakings under sections 18 or 19 of the Water Industry Act 1991. At this stage we do not consider such action to be appropriate, given the further design and feasibility work that needs to be done, or necessary for Thames Water to be able to take matters forward with Ofwat and the Environment Agency".* It is thus clear that if Thames Water were to fail to progress the proposal for a tunnel it would be subject to enforcement action.

The need for the project

1.1.56 The NPS advises (para. 2.6.34) that it is for "*… Thames Water to justify the specific design and route of the proposed project..*" in its application, within a number of fixed parameters clearly set out in the NPS.

1.1.57 As stated in the NPS, the proposed project comprises *"a major tunnel, likely to run for approximately 25 kilometres from West to East London to intercept storm sewage overflows and transfer them for treatment at Beckton Sewage Treatment works (STW) in East London. A major part of the tunnel route is likely to follow the course of the River Thames"* (para. A1.3.2).

1.1.58 The tunnel would *"pick up any unsatisfactory overflows discharging direct to the tidal Thames" (*para. 2.6.25 of the NPS).

1.1.59 The NPS further identifies the role of the Environment Agency in defining the nature of the necessary project in greater detail. The Environment Agency has been involved in the project since the inception of the *TTSS*

steering group in 2001 and has identified the CSOs that require interception.

1.1.60 The Environment Agency has undertaken the following assessments of CSOs:

a. 2004: assessment to determine which CSOs were unsatisfactory

b. 2006: a more detailed assessment of the impacts on health and aesthetics to assess the effectiveness of shorter tunnel options

c. 2008: a review of the categorisation of CSOs

d. 2011: a review of the categorisation of CSOs.

1.1.61 Each investigation, review and assessment was based on the best available evidence at the time. The Environment Agency has periodically reviewed the evidence as more comprehensive information has emerged.

1.1.62 The Environment Agency has stated that each review supported the initial assessments made in 2004 as part of the *TTSS*.

1.1.63 In respect of the 2011 review of the categorisation of CSOs, the Environment Agency concluded: *"As the result of our reviews, we are satisfied that all the CSOs Thames Water are planning to connect to the Thames Tunnel are unsatisfactory and need to be addressed"*.

1.1.64 The project for which development consent is sought has evolved on the basis of the need to control all the CSOs identified as unsatisfactory by the Environment Agency. Work on developing the project commenced before the publication of the draft NPS; however, the tunnel proposed as part of the project complies with the advice of the Environment Agency, as required by the NPS.

1.1.65 The *London Tideway Tunnels Operating Techniques relating to the Tideway Combined Sewer Overflow (CSO) and the Actively Managed CSOs to the tidal Thames* were agreed between Thames Water and the Environment Agency on 8 November 2012. This document describes the principles in relation to the operation of the London Tideway Tunnels[v] to reduce CSO discharges into the tidal Thames (including from the Tideway CSO, which will be created as part of the Lee Tunnel project).

Other benefits

1.1.66 There are a number of benefits that follow from the implementation of the Thames Tideway Tunnel. These relate to:

a. meeting the ecological water quality objectives for the Thames

b. reducing risk to human health

c. addressing negative aesthetic impacts

d. reputational risk to the UK.

1.1.67 During the work on the TTSS bespoke water quality standards for dissolved oxygen were developed for the River Thames. If levels of dissolved oxygen fall, or sag, there can be large scale fish kills. The

[v] 'London Tideway Tunnels' are the Lee Tunnel (under construction), and the Thames Tideway Tunnel

standards are significant in terms of achieving WFD objectives but also for ecological quality. It has been reasoned that fish are the most sensitive indicator of ecological quality. Appendix F of the *Needs Report* discusses this in more detail and the effects are assessed in Volume 3 Sections 5 and 11 of the *Environmental Statement* (Project-wide effects assessment: Section 5 Ecology – aquatic, and Section 11 Water resources – surface water).

1.1.68 There are also human health benefits. Recreational users of the River Thames would benefit from the improved water quality. Those users and others who live, work or visit close to the Thames would benefit from the substantial enhancement in the aesthetic quality of the river and its foreshore. These benefits are addressed in Volume 3 Sections 10 and 11 of the *Environmental Statement* (Project-wide effects assessment: Section 10 Socio-economics, and Section 11 Water resources – surface water) and the *Health Impact Assessment,* which accompanies the application).

1.1.69 Additionally, there would be substantial, unquantifiable benefits to the reputation of London and the UK if the project can proceed and bring compliance to the capital's river. Significant economic and other benefits would flow from the project, which would provide the necessary capacity to enable the further sustainable growth of London.

Conclusion on need

1.1.70 The Environment Agency is satisfied that all the CSOs that Thames Water plans to control as part of the Thames Tideway Tunnel project are unsatisfactory and need to be addressed.

1.1.71 The case for a Thames Tideway Tunnel has been clearly established by the NPS. It sets out the urgency of the established need, which became more urgent when the UK was found to be in breach of the UWWTD in respect of the Beckton and Crossness catchments. The non-completion of the project means that the UK Government continues to be in breach of the UWWTD and must still take the necessary measures to comply with the judgment of the European Court of Justice. A Thames Tideway Tunnel is the only available means of achieving compliance. The European Commission could seek fines that the Government believes could be in excess of £100 million a year. Furthermore, it is essential for the reputation of the UK and its capital city to address the issue as soon as possible. Therefore the need is urgent.

1.2 Structure of the Environmental Statement

Introduction

1.2.1 The *Environmental Statement* consists of 27 volumes. A separate *Non-Technical Summary* has also been prepared.

1.2.2 Vol 1 provides an introduction to the *Environmental Statement*, a high level summary of the proposed development, and information on the project alternatives considered. Vol 2 describes the environmental assessment methodology utilised. Vol 3 presents the project-wide effects

assessment and Vols 4 to 27 presents the effects assessments for each of the 24 construction sites.

Report content and structure

1.2.3 The *Environmental Statement* has been structured in such a way as to enable ease of use, whether the reader is considering the project as a whole, particular sites, or particular topics. The *Environmental Statement* structure is summarised in the plates below (Vol 1 Plate 1.2.1 to Vol 1 Plate 1.2.4).

1.2.4 Each page within the *Environmental Statement* has a unique identifier in the page footer which is based on the volume number and title, the section number and title, and the page number (see Vol 1 Plate 1.2.5).

1.2.5 The *Environmental Statement* volume numbers and titles are presented in Vol 1 Table 1.2.1. Vols 2 to 27 have separate volumes of appendices and figures.

Vol 1 Table 1.2.1 Environmental Statement volume numbers and titles

Volume number	Volume title
Environmental Statement glossary and abbreviations	
1	Introduction to the Environmental Statement
2	Environmental assessment methodology
3	Project-wide effects assessment
4	Acton Storm Tanks site assessment
5	Hammersmith Pumping Station site assessment
6	Barn Elms site assessment
7	Putney Embankment Foreshore site assessment
8	Dormay Street site assessment
9	King George's Park site assessment
10	Carnwath Road Riverside site assessment
11	Falconbrook Pumping Station site assessment
12	Cremorne Wharf Depot site assessment
13	Chelsea Embankment Foreshore site assessment
14	Kirtling Street site assessment
15	Heathwall Pumping Station site assessment
16	Albert Embankment Foreshore site assessment
17	Victoria Embankment Foreshore site assessment
18	Blackfriars Bridge Foreshore site assessment

Volume number	Volume title
19	Shad Thames Pumping Station site
20	Chambers Wharf site assessment
21	King Edward Memorial Park Foreshore site assessment
22	Earl Pumping Station site assessment
23	Deptford Church Street site assessment
24	Greenwich Pumping Station site assessment
25	Abbey Mills Pumping Station site assessment
26	Beckton Sewage Treatment Works site assessment
27	Minor work sites assessment

1.2.6 To ensure a consistent approach across all of the effects assessments (Vols 3 to 27) the section numbers for the introductory information and specific topic assessments in each of these volumes are as follows (Vol 1 Table 1.2.2). For ease of cross-reference the topic sections within Vol 2 Environmental assessment methodology are the same as those used in the effects assessment volumes (ie, Section 4 through to 15).

Vol 1 Table 1.2.2 Environmental Statement - effects assessments (Vols 3 to 27) section numbers and titles

Section number	Section title
Section 1	Introduction
Section 2	Site/project context
Section 3	Proposed development
Section 4	Air quality and odour
Section 5	Ecology – aquatic
Section 6	Ecology – terrestrial
Section 7	Historic environment
Section 8	Land quality
Section 9	Noise and vibration
Section 10	Socio-economics
Section 11	Townscape and visual
Section 12	Transport
Section 13	Water resources - groundwater
Section 14	Water resources – surface water
Section 15	Water resources – flood risk

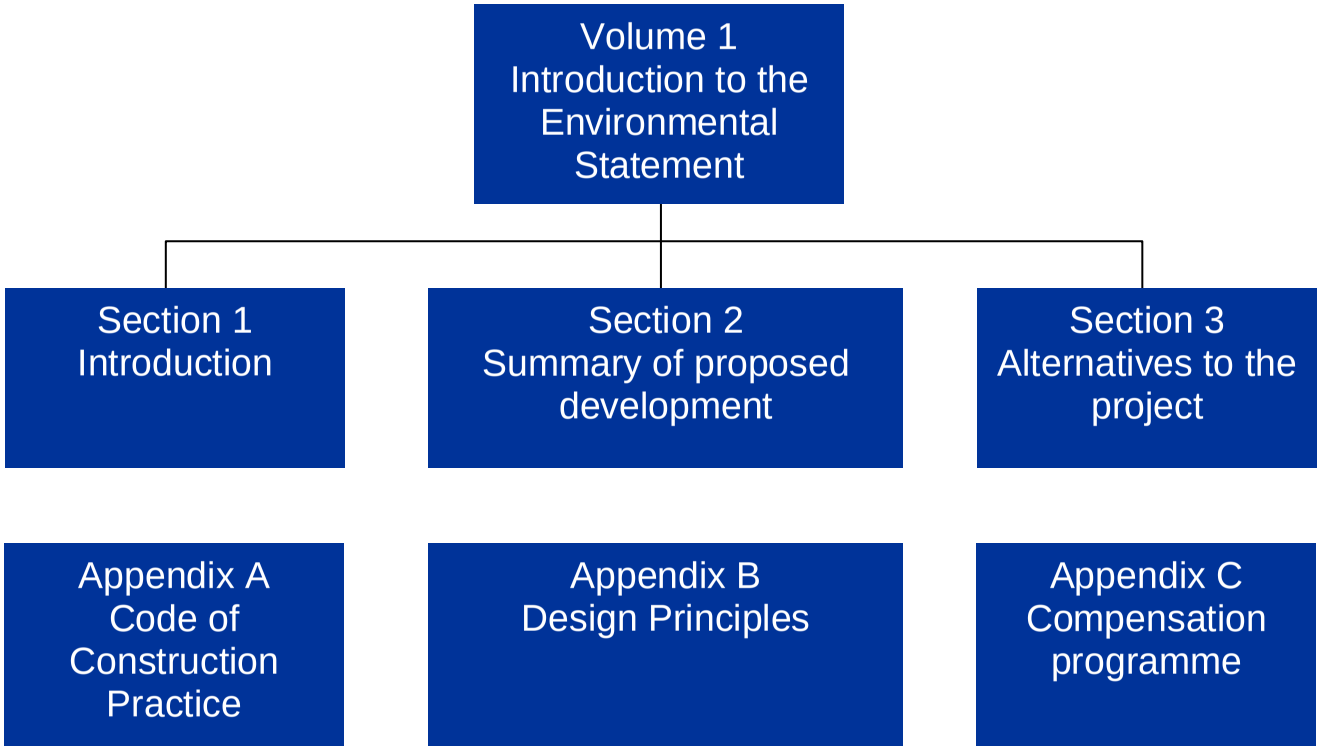
1.2.7 To ensure a consistent approach across all of the topic assessments the topic section numbers for each (excluding the water resources – flood risk assessments[vi]) are as follows (Vol 1 Table 1.2.3).

Vol 1 Table 1.2.3 Environmental Statement - topic assessment sections (Vols 3 to 27) sub-section numbers and titles

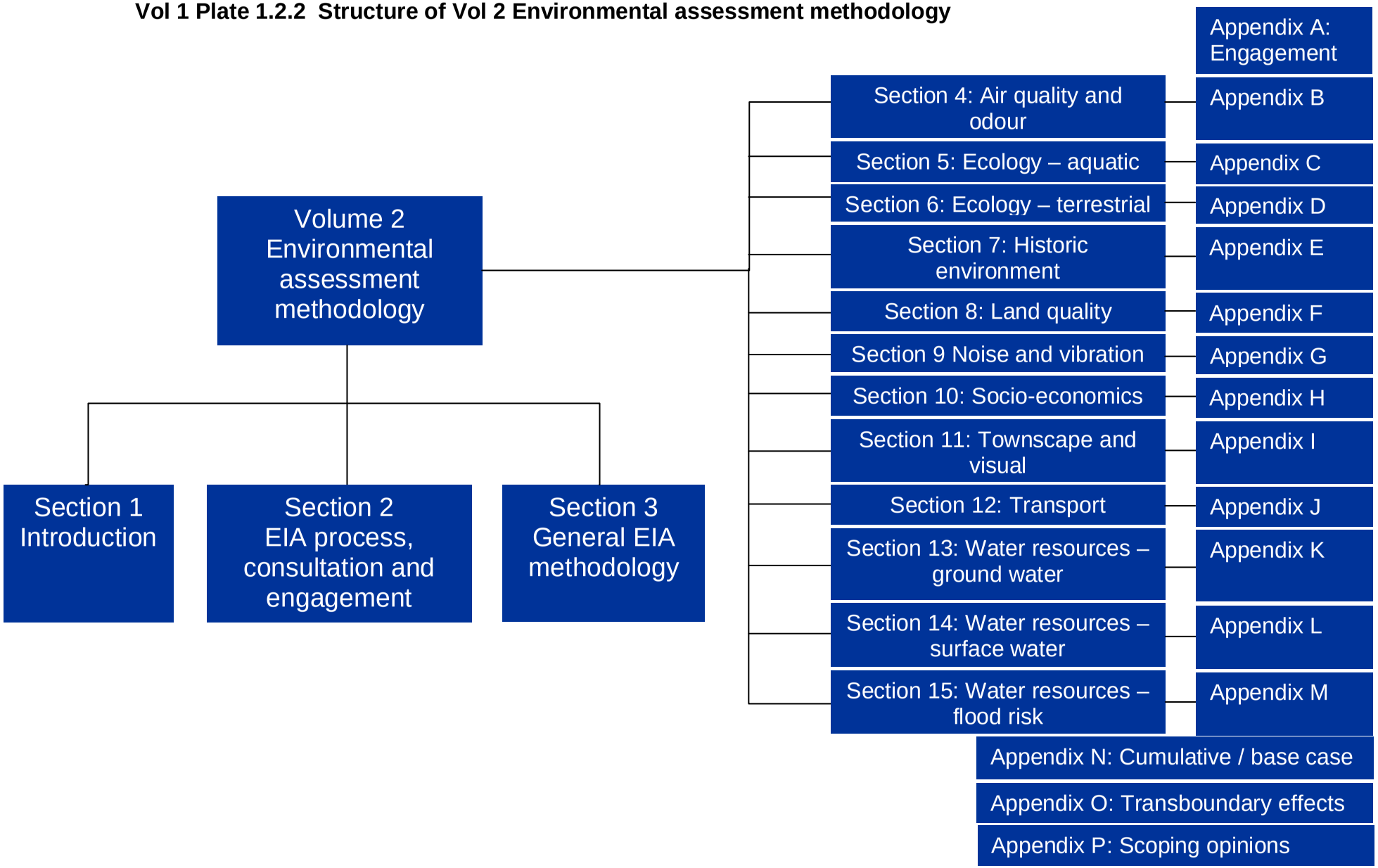
Section number	Section title
Sub-section 1	Introduction
Sub-section 2	Proposed development relevant to topic
Sub-section 3	Assessment methodology
Sub-section 4	Baseline conditions
Sub-section 5	Construction effects assessment
Sub-section 6	Operational effects assessment
Sub-section 7	Cumulative effects assessment
Sub-section 8	Mitigation
Sub-section 9	Residual effects assessment
Sub-section 10	Effects assessment summary
References	

[vi] Due to the nature of a flood risk assessment, the risk based approach outlined in the *NPPF* (Communities and Local Government, 2012) was considered to be preferable to the general EIA methodology described in Vol 2, Section 3. This approach is based on the probability of an event occurring as a result of the proposed development rather than a direct change in conditions. This is detailed further in the flood risk assessment methodology (Volume 2 Section 15), and this also takes into account of the requirements of Section 4.4 (Flood risk) of the *NPS*.

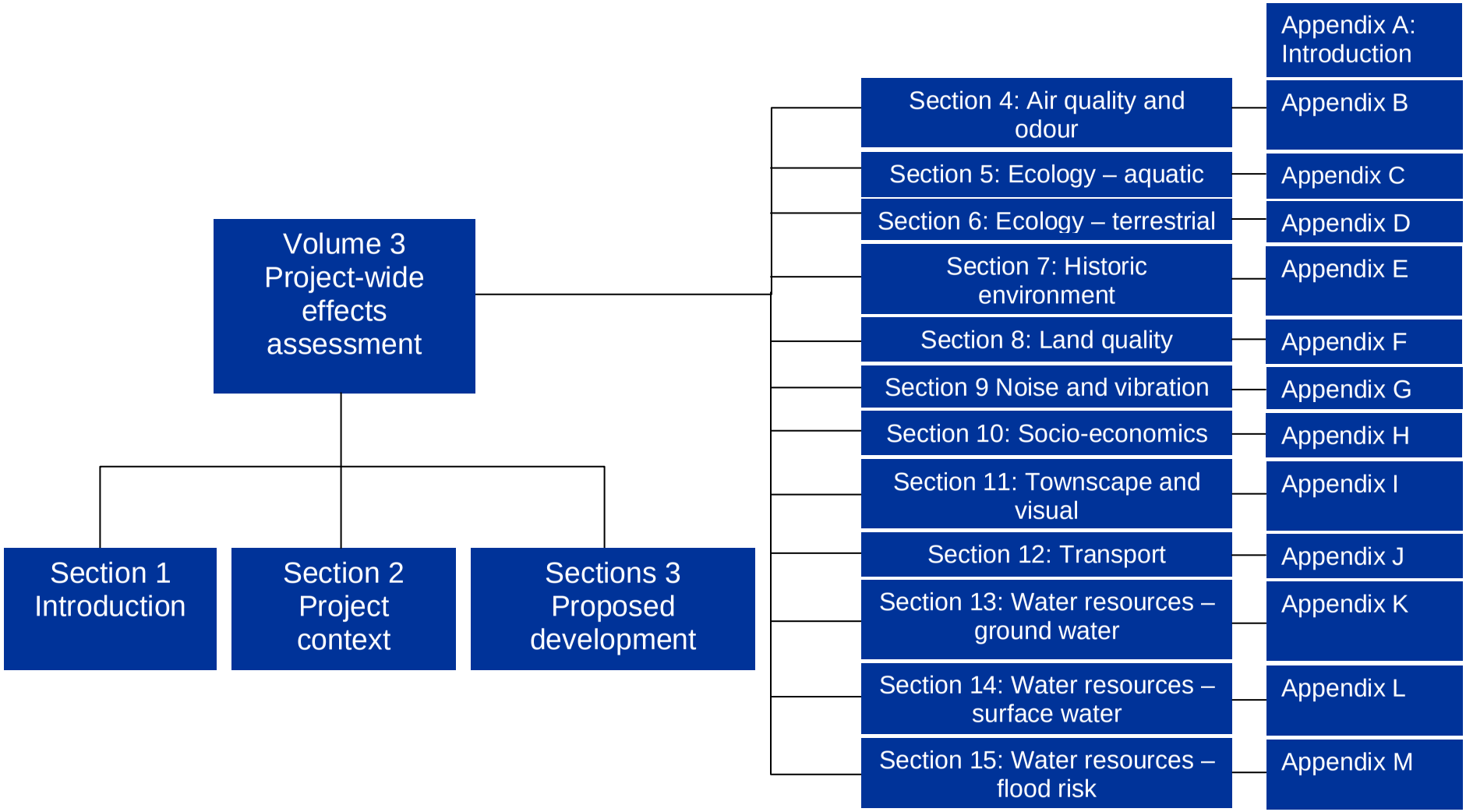
Vol 1 Plate 1.2.1 Structure of Vol 1 Introduction to the Environmental Statement



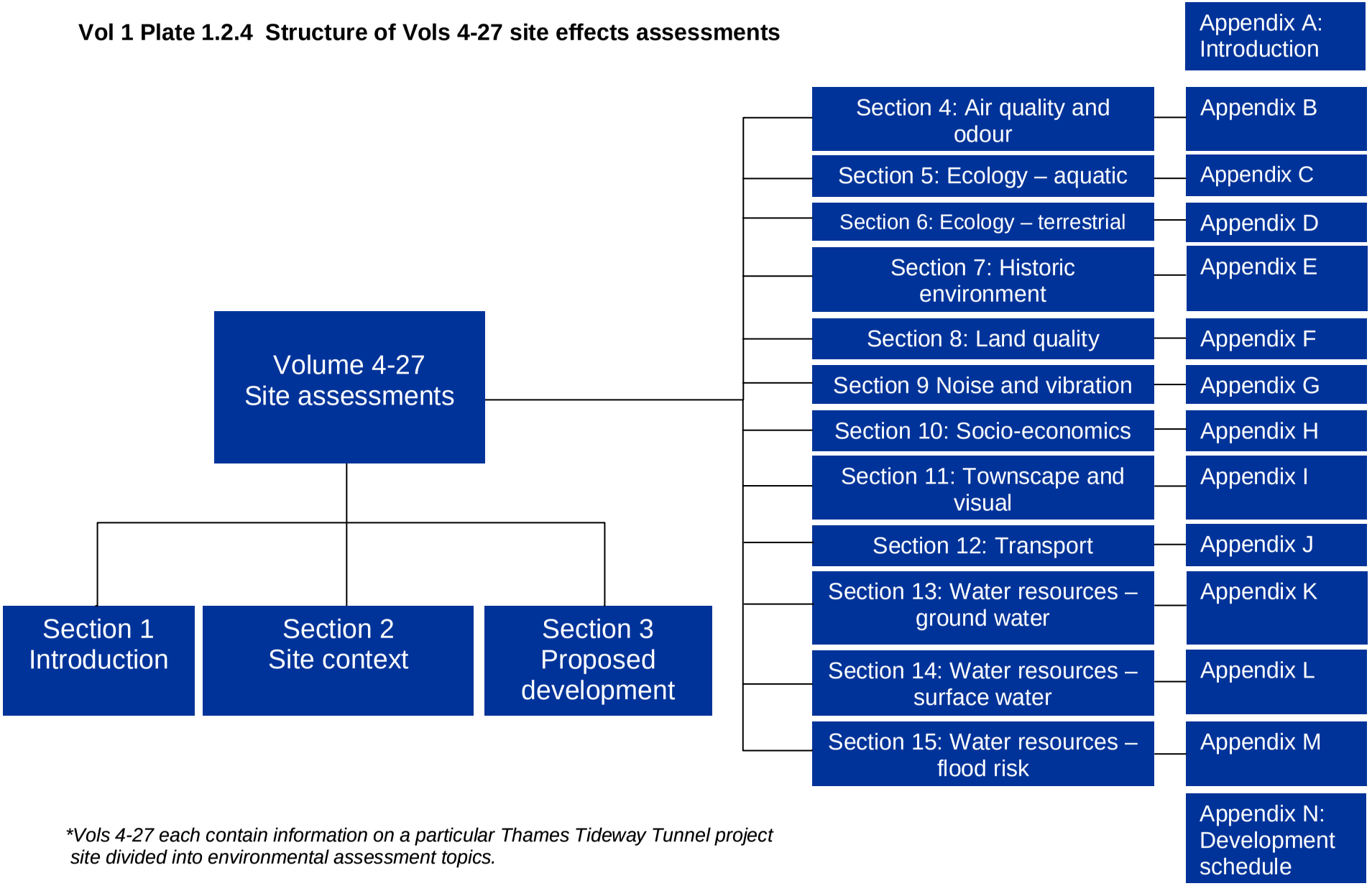
Vol 1 Plate 1.2.2 Structure of Vol 2 Environmental assessment methodology



Vol 1 Plate 1.2.3 Structure of Vol 3 Project-wide effects assessment

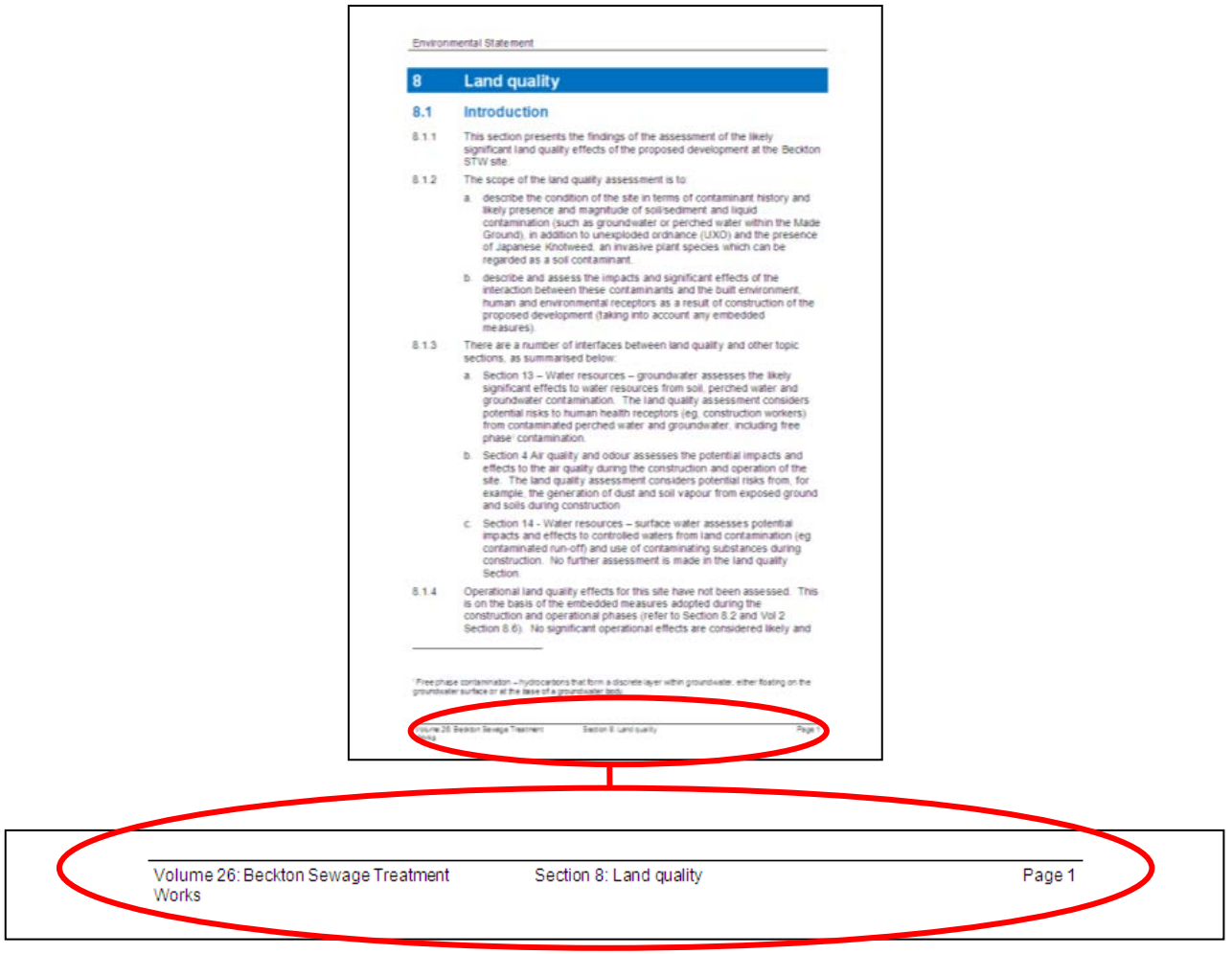


Vol 1 Plate 1.2.4 Structure of Vols 4-27 site effects assessments



**Vols 4-27 each contain information on a particular Thames Tideway Tunnel project site divided into environmental assessment topics.*

Vol 1 Plate 1.2.5 Environmental Statement page layout



Note: The volume number, section number and page number are indicated in the footer of each document, so every page in the Environmental Statement has a unique identifier.

Other application documents duplicated within the *Environmental Statement*

1.2.8 The following plans and documents which accompany the application are also duplicated within the *Environmental Statement* as they define the project that has been environmentally assessed:

a. relevant plans from *the Book of Plans* – the relevant plans are included in Vol 3 Project-wide effects figures, and Vols 4 to 27 (site assessment volumes) figures

b. *Code of Construction Practice (CoCP) Part A and Part B* (Vol 1 Appendix A)

c. *Design Principles report* (Vol 1 Appendix B).

d. Compensation programme (Vol 1 Appendix C).

Requirements of Regulation 5 of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 addressed by the *Environmental Statement*

1.2.9 Section 37(3)(d) of the 2008 Act provides that an application for development consent must be accompanied by documents and information of a prescribed description. Regulation 5(2) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 lists the prescribed documents and information which must accompany the application.

1.2.10 Regulation 5(2)(a) requires the application to be accompanied by an environmental statement required pursuant to the 2009 EIA Regulations and any scoping or screening opinions or directions. This document is the *Environmental Statement*, and scoping opinions are provided in the appendices that accompany Volume 2 of the *Environmental Statement*.

1.2.11 Regulation 5 (2)(e) requires that the application be accompanied by a copy of any flood risk assessment (FRA). The FRA is included within the *Environmental Statement.* The project-wide FRA is located in Vol 3 Project-wide effects assessment Section 15; and the site specific FRAs are located in Vols 4 - 27 (site assessments) Section 15; and the associated volumes of figures and appendices[vii].

1.2.12 Regulation 5 (2)(l) requires the application to be accompanied by where applicable a plan with accompanying information identifying (i) any statutory or non-statutory sites or features of nature conservation such as sites of geological or landscape importance; (ii) habitats of protected species, important habitats or other diversity features; and (iii) water bodies in a river basin management plan, together with an assessment of any effects on such sites, features or habitats likely to be caused by the proposed development. This information is provided within the *Environmental Statement.* Environmental setting plans, which include

[vii] The Flood Risk Assessment is contained within the *Environmental Statement* in line with the scoping opinion provided by the Environment Agency.

information on items i), ii) and iii) (above), where relevant, are provided in Section 2 of Vols 3 to 27, and Vol 2 Figure 14.4.1 (water bodies) and in the associated volumes of figures and appendices. Assessments of effects on such sites identified in items i), ii), and iii), above, where relevant, are provided within Sections 5 (aquatic ecology) and 6 (terrestrial ecology) of Vols 3 to 27, and in the associated volumes of figures and appendices, and other topic assessment sections where necessary.

1.2.13 Regulation 5 (2)(m) requires the application to be accompanied by a plan with accompanying information identifying any statutory or non-statutory sites or features of the historic environment, including scheduled monuments, World Heritage sites, listed buildings and other historic structures, archaeological sites and registered battlefields, together with an assessment of any effects on such sites, features or structures likely to be caused by the proposed development. This information is provided within the *Environmental Statement.* Historic environment features maps and effects assessments, which include the above information, where relevant, are included in Section 7 of Vols 3 to 27, and in the associated volumes of figures and appendices. The *Environmental Statement* assesses the likely significant effects of the proposals on the historic environment, and incorporates much of the above information, where relevant. The *Heritage Statement*, which also accompanies the application, is a standalone document that includes the historic environment plans and report, and assesses the significant and the less significant effects of the proposals on the historic environment, and considers these in relation to the criteria and policies in the NPS.

1.3 Statutory framework for environmental impact assessment

1.3.1 This section sets out the statutory framework relevant to the environmental impact assessment that has been carried out in respect of the project. It establishes the environmental assessment requirements associated with Part 1 Schedule 4 of the 2009 EIA Regulations. As the 2008 Act also requires that the decision maker must decide an application in accordance with the relevant NPS, the relevant environmental factors contained in the NPS for examination and determination of applications are also set out.

Requirements relating to the 2009 EIA Regulations

1.3.2 The *Environmental Statement* has been prepared in accordance with the requirements of the 2009 EIA Regulations.

1.3.3 Before carrying out phase one consultation and phase two consultation, IPC (as it then was) was notified in writing that an *Environmental Statement* would be provided in respect of the project. These notifications were provided by letters dated 9 September 2010 (in the case of phase one consultation) and 2 November 2011 (in the case of phase two consultation). The notifications would have complied with the requirements of Regulations 6(1)(b) and 6(3) of the 2009 EIA Regulations, had they been issued after the Section 14(3) Order came into force.

1.3.4 By letter dated 9 December 2011, the IPC confirmed that the content and timing of the notifications reflected the relevant statutory requirements.

1.3.5 The Thames Tideway Tunnel project *Scoping Report* (Thames Water, 2011)[2] was submitted in March 2011 in support of a request for scoping opinions under Regulation 4 of the Town and Country Planning (Environmental Impact Assessment) Regulations 1999 (as amended) (the 1999 EIA Regulations) (which were the regulations applicable at the time) to each local authority within which the project is located.

1.3.6 It was anticipated, however, that the project would be designated as a Nationally Significant Infrastructure Project (NSIP) and would therefore be determined by the IPC (now the Planning Inspectorate) in accordance with the 2008 Act and its associated EIA legislation, the 2009 EIA Regulations. Consequently, an approach was adopted which shadowed the 2009 EIA Regulations alongside the 1999 EIA Regulations, ensuring both sets of requirements were met. In this respect, the IPC was also consulted on the scope of the *Environmental Statement* during the scoping stage, as if Regulation 8 of the 2009 EIA Regulations formally applied to the project.

1.3.7 Regulation 10 of the 2009 EIA Regulations requires that the statement of community consultation prepared under Section 47 of the 2008 Act must set out how preliminary environmental information will be publicised and consulted on. The *Consultation Report*, which accompanies the application, summarises the consultation approach that has been adopted, consultation queries and responses, and demonstrates how this requirement has been addressed.

1.3.8 Part 1 of Schedule 4 of the 2009 EIA Regulations provides details of the information required for inclusion in this *Environmental Statement* and is reproduced in Vol 1 Table 1.3.1, below. The table also includes details of where the information requirements are addressed, and how the other relevant requirements of the 2009 EIA Regulations have been complied with.

Vol 1 Table 1.3.1 2009 EIA Regulations requirements

Para.	Requirements	Location within the *Environmental Statement*
Part 1, Schedule 4		
17	Description of the development, including in particular: • a description of the physical characteristics of the whole development and the land-use requirements during the construction and operational phases. • a description of the main characteristics of the production processes, for instance, nature and quantity of materials used. • an estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc) resulting from the operation of the proposed development.	Vol 1, Section 2 (summary) Vol 3 Project-wide effects assessment Section 3 Vols 4 to 27 (site effects assessments) Section 3
18	An outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects.	Vol 1 Section 3 Vols 4 to 27 (site effects assessments) Section 3.6
19	A description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.	Vol 3 Project-wide effects assessment Section 2 Vols 4 to 27 (site effects assessments) Section 2
20	A description of the likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary,	Construction and operational effects sections are included in: Vol 3 Project-wide effects assessment Sections 4 to 15 Vols 4 to 27 (site effects assessments) Section 4 to 15

Para.	Requirements	Location within the *Environmental Statement*
	positive and negative effects* of the development, resulting from the: • existence of the development • use of natural resources • emission of pollutants, the creation of nuisances and the elimination of waste and • the description by the applicant of the forecasting methods used to assess the effects on the environment.	
21	A description of the initial measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment (and seeking input from the public on their views on mitigation).	Mitigation (and engagement) sections are included in: Vol 3 Project-wide effects assessment Sections 4 to 15 Vols 4 to 27 (site effects assessments) Sections 4 to 15
22	A non-technical summary of the information provided under paras. 1 to 5, above (ie, paras. 17 to 21 of this table).	A non-technical summary is provided as a separate document
23	An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the applicant in compiling the required information.	Assumptions and limitations sections are included in: Vol 3 Project-wide effects assessment Sections 4 to 15 Vols 4 to 27 (site effects assessments) Sections 4 to 15
Regulation 6: Procedure for establishing whether environmental impact assessment is required		
6(1)(b) and 6(3)	Before carrying out the Section 42 consultation, either (a) request the Secretary of State to adopt a screening opinion in respect of the development to which the application relates, or (b) notify the Secretary of State in writing that it proposed to provide an environmental statement in respect of that development.	Given the scale and complexity of the project, a screening opinion was not sought since the proposed development is considered likely to have significant effects on the environment. Before carrying out phase one consultation and phase two consultation, IPC (as it then was) was notified in writing that an *Environmental Statement* would be provided in respect of the project. These notifications were provided by letters dated 9

Para.	Requirements	Location within the *Environmental Statement*
		September 2010 (in the case of phase one consultation) and 2 November 2011 (in the case of phase two consultation). The notifications would have complied with the requirements of Regulations 6(1)(b) and 6(3) of the 2009 EIA Regulations, had they been issued after the Section 14(3) Order came into force. By letter dated 9 December 2011, the IPC confirmed that the content and timing of the notifications reflected the relevant statutory requirements.
Regulation 8: Application for a scoping opinion		
8(1)	A person who proposes to make an application may ask the Commission to state in writing its opinion as to the information to be provided in the environmental statement.	The Thames Tideway Tunnel project *Scoping Report*[3] was submitted to the IPC in March 2011 (see para. 1.3.3 to 1.3.6).
Regulation 10: Consultation Statement requirements		
10 (a) and (b)	The consultation statement prepared under Section 47 (duty to consult local community) must set out how the applicant intends to publicise and consult on the preliminary environmental information.	The Thames Tideway Tunnel *Statement of Community Consultation* prepared under Section 47 of the 2008 Act set out how Thames Water intends to publicise and consult on the preliminary environmental information. The statement was published at the start of phase one consultation on 13 January 2010, and a revised version was published at the start of phase two consultation on 4 November 2011.
Regulation 11: Pre-application publicity under Section 48 (duty to publicise)		
	The applicant must, at the same time as publishing notice of the proposed application under section 48(1), send a copy of that notice to the consultation bodies and to any person notified to the applicant in accordance with Regulation 9(1)(c).	A copy of the Section 48 notice was sent to the EIA consultation bodies, being relevant prescribed persons specified in Schedule 1 to the 2009 APFP Regulations (as amended), all relevant local authorities within Section 43 of the 2008 Act and the GLA. Thames Water was not notified of any persons pursuant to Regulation 9(1)(c) of the 2009 EIA

Para.	Requirements	Location within the *Environmental Statement*
		Regulations (as amended).
Regulation 24: Development with significant transboundary effects		
	This regulation applies where one of the events mentioned in Regulation 4(2) occurs and the Secretary of State is of the view that the development is likely to have significant effects on the environment in another EEA State, or another EEA State likely to be significantly affected by the development so requests. One of the events mentioned in Regulation 4(2) a person notifying the Secretary of State under Regulation 6(1)(b) that they propose to provide an environmental statement in respect of the proposed development.	As set out above, prior to phase one and phase two consultation the IPC (as it then was) was notified that an *Environmental Statement* would be provided as if regulation 6(1)(b) of the 2009 EIA Regulations applied. The *Environmental Statement* considers the potential for transboundary effects in Vol 2 Section 2.4, and in Vol 2 Appendix O

** how these terms have been interpreted in the Environmental Statement is explained in Vol 2 Environmental assessment methodology*

Consideration of specific issues identified in the 2009 EIA Regulations

1.3.9 The aspects of the 2009 EIA Regulations considered below are not intended to be exhaustive. They have been included here because of their general relevance to the *Environmental Statement*, and how the environmental assessment has been undertaken. They merit specific consideration as part of the overall introduction to the *Environmental Statement*, and provide useful cross-references to where further information on these aspects can be found within it.

Alternatives to the project (Part 1, Schedule 4, Para. 18)

1.3.10 The alternatives to the project that have been considered are included within the *Environmental Statement*. This includes alternatives to a tunnel solution, alternative tunnel routes, and alternative sites. Information is provided on how environmental and other factors have influenced the decisions taken with regard to the proposed development.

1.3.11 The project-wide and site selection alternatives to the project are presented in Section 3 of this volume. This includes a description of:

a. strategic alternatives

b. storage and transfer tunnel options

c. Thames Tideway Tunnel routes

d. main construction sites and drive strategy

e. CSO sites.

1.3.12 Each site effects assessment (Vols 4 to 27, Section 3.6) describes the on-site alternatives that have been considered and provides the main reasons why these alternatives (to the proposed approach) have not been adopted.

Climate change (Part 1, Schedule 4, Para. 19 – climatic factors)

1.3.13 Climate change is likely to mean changes in future weather patterns; with warmer temperatures, continued sea level rise, changes to seasonal rainfall and more extreme events. This may increase the risk of flooding and drought events.

1.3.14 Climate change is an acknowledged issue which has driven the design and proposals for construction and operation of the project. The effects of climate change on the project, and any effects of the project on climate change, have been included within the assessments in the *Environmental Statement* where necessary

1.3.15 The best available climate projections for the UK are the UKCP09[4] projections, based upon the Met Office Hadley Centre climate models. UKCP09 provides an estimate of the range of model-related uncertainties in the future projections, along with high, medium and low emissions scenarios. The 10, 50 and 90 percentiles have been used to explore the implications of these uncertainties for the 2050s (2040 to 2069) and 2080s (2070 to 2099) time horizons.

1.3.16 In order to understand the impacts of climate change on the Thames Tideway Tunnel project, and *vice versa*, the above time horizon scenarios

have been simulated in the catchment model that represents the urban area and the sewerage network. Future temperature parameters and river flow, which are important when modelling the water quality of the tidal Thames, have also been assessed. The water quality of the river is influenced by the tidal Thames's condition so future change to dew point temperature, solar radiation, river temperature, sea temperature and river flow could significantly impact the tidal Thames, regardless of rainfall-runoff over the urban catchments.

1.3.17 The climate change modelling undertaken has informed the environmental assessments undertaken where necessary. The base cases for the topic assessments have been developed by factoring in climate change predictions, for example, increased river levels.

1.3.18 Thames Water has actively sought to respond to climate change in the context of the topics addressed within the environmental assessment, where relevant, including, for example:

a. transport – the project has sought to maximise the use of river transport over road transport, thus reducing carbon dioxide emissions

b. flood risk – the design of the project increases the overall level of flood protection afforded by flood defences. The design life of the project has been maximised by undertaking climate change modelling and population growth assessments.

1.3.19 Further details of the emissions associated with the project are provided in a separate *Energy and Carbon Footprint Report* whilst sustainability matters more broadly are covered in the *Sustainability Statement*. Both of these documents accompany the application.

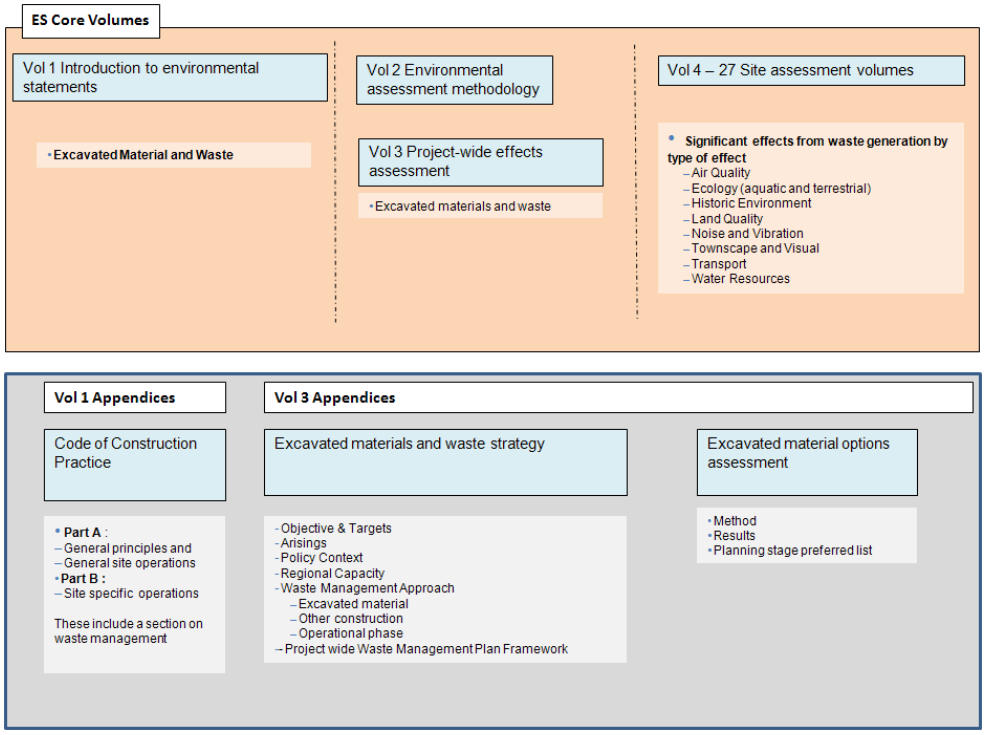
1.3.20 The *Resilience to Change* report, which accompanies the application, includes further information regarding the project approach to climate change.

Excavated material and waste (Part 1, Schedule 4, Para. 20 - waste)

1.3.21 The management, storage and transport of the excavated materials and wastes which arise at each site forms an integral part of the construction phase at each of the Thames Tideway Tunnel sites. The on-site and near-site environmental effects of this material are therefore captured within the consideration of construction effects for each topic within each site volume (Vols 4 to 27). Where relevant, this also includes consideration of the environmental effects of transporting the material to the Transport for London Road Network.

1.3.22 A summary of how excavated material and waste is addressed within the *Environmental Statement* is summarised in Vol 1 Plate 1.3.1, below.

Vol 1 Plate 1.3.1 Excavated material and waste – linkages with the *Environmental Statement*



1.3.23 The project *Waste Management Plan (WMP)* is provided Vol 3 Appendix A.3.

1.3.24 The *Excavated Materials and Waste Strategy (EM&WS)* (see Vol 3 Appendix A.3) has been developed to provide a framework for the management of excavated materials and waste that would be produced throughout the construction and operational phases of the Thames Tideway Tunnel project.

1.3.25 The *Excavated Materials Options Assessment (EMOA),* (Vol 3 Project-wide effects assessment Appendix A.4) uses a bespoke approach, developed in consultation with the Environment Agency that assesses the suitability of receptor sites that could receive excavated material from the Thames Tideway Tunnel project.

1.3.26 The destination of excavated material would avoid sensitive sites, and dumping at sea would not be undertaken.

1.3.27 Detailed information on the approach to excavated material and waste is provided in Vol 3 Section 1.6.

Cumulative effects (Part 1, Schedule 4, Para. 20 – cumulative effects)

1.3.28 Cumulative effects are those effects that arise from the Thames Tideway Tunnel project together with other non-Thames Tideway Tunnel projects.

1.3.29 The potential accumulation of the likely significant effects of the project with other developments has been carefully considered so that the greatest adverse effects are identified and assessed against the baseline position. In assessing these cumulative effects, the other developments have been identified through consultation with the local planning authorities and other relevant authorities.

1.3.30 Numerous other projects that could materially affect the results of the environmental assessment have been identified, collated into development schedules, reviewed and assessed where necessary.

1.3.31 Each of the *Environmental Statement* volumes addressing environmental effects includes a dedicated section on cumulative effects (Vol 3 Section 3.5, and Vols 4 to 27, Section 3.5). The development schedules on which the cumulative effects assessments have been based are provided in Vol 3 Appendix A.1, and Vols 4 to 27 Appendix N.

1.3.32 Detailed information on the approach to cumulative effects assessment is provided in Vol 2 Section 3.8.

Effect interactions (Part 1, Schedule 4, Para. 20 – indirect/secondary effects)

1.3.33 Effect interactions (the inter-relationship of effects) on receptors may occur where a number of separate effects, eg noise and air quality, affect receptors such as fauna.

1.3.34 The effect interactions between aspects of the proposed development have been assessed in each of the *Environmental Statement* site assessment volumes (Vols 4 to 27 site assessment volumes) and details are also provided as to how effect interactions have been assessed in order to address the environmental effects of the proposal as a whole (Vol 3 Project-wide effects assessment). For example, the consideration of amenity effects within the socio-economic assessments includes combined noise, air quality and visual effects.

1.3.35 Where necessary, the text of the specialist topics in the *Environmental Statement* effects assessment volumes cross refer to other relevant disciplines to ensure that the *Environmental Statement* is not a collection of separate specialist topics, but a comprehensive assessment of the environmental effects of the project.

Embedded environmental design measures (Part 1, Schedule 4, Para. 21)

1.3.36 As an overarching principle, Thames Water has actively sought to prevent/avoid, reduce or offset adverse environmental effects and consider beneficial effects.

1.3.37 In practice, this has involved a collaborative and partly sequential, partly iterative approach to identifying potentially adverse impacts and effects and determining appropriate design measures to address these. For example, the effects of noise upon residential receptors have been identified by noise specialists as a result of demolition and construction activities. These impacts and effects, in particular significant ones, have then been regularly communicated to the project team for attention, principally through regular design workshops, alongside suggested measures to prevent/avoid or reduce them.

1.3.38 In reaching a decision on which measures to incorporate, environmental considerations have then been reviewed alongside other factors such as design feasibility, planning and land ownership. Once these measures

have been incorporated they have been termed ‘embedded measures’ or ‘environmental design measures’.

1.3.39 Embedded measure commitments relevant to the construction phase are contained primarily in the *CoCP* and are referenced throughout the *Environmental Statement*. For the operation phase, such embedded measures and commitments are represented primarily in the *Design Principles* document. The *Environmental Statement* assesses effects with embedded environmental design measures in place.

1.3.40 The embedded environmental design measure commitments that have been made in the *CoCP* and *Design Principles* report would be secured through appropriate requirements included in Schedule 3 of the *Draft Development Consent Order (DCO)*.

Approach to mitigation (Part 1, Schedule 4, Para. 21)

1.3.41 Where significant adverse effects are identified (after considering these embedded measures), further ‘mitigation measures’ have been proposed. Further details on the definition of significance is provided in Section 3.7. Generally, mitigation measures have only been recommended for significant adverse effects, unless stated and explained otherwise (for example, Historic environment).

1.3.42 Mitigation measure commitments that have been made in the *Environmental Statement* would be secured, where relevant, through appropriate requirements included in *Schedule 3 of the Draft DCO*[viii].

1.3.43 An assessment of effects has been made with mitigation measures in place and this is termed the ‘residual effects assessment’. In some cases, mitigation measures may not be possible or appropriate, meaning that there are residual significant effects.

1.3.44 On the whole, the general approach to the project has been such that most measures for preventing/avoiding or reducing effects have been embedded into the project, meaning that few mitigation measures are required.

1.3.45 Further information on the approach to mitigation and offsetting/compensation can be found in Section 3.2 of Volume 2.

Compensation programme

1.3.46 Volume 1 Appendix C contains the documents which comprise the Thames Tideway Tunnel compensation programme. They are as follows:

a. Exceptional hardship procedure

b. Non-statutory mitigation compensation scheme

c. Non-statutory disturbance compensation scheme

d. Noise insulation and temporary re-housing policy

e. Settlement information paper

[viii] certain commitments are also proposed to be secured through other means (eg, section 106 agreements/undertakings with local authorities or separate agreements with the Environment Agency – see Section 2.6 the *Planning Statement* which accompanies the application)

1.3.47 The above documents are also reproduced in the *Statement of Reasons*.

1.3.48 Where appropriate, measures proposed as part of the compensation programme have been used in the EIA as a means of mitigating or off-setting potential adverse environmental effects. Details of this are contained in the relevant topic assessments in the site assessment volumes.

Transboundary effects (Regulation 24)

1.3.49 Transboundary effects are those that might have an effect on the environment of another European Economic Area (EEA) Member State.

1.3.50 Regulation 24 of the 2009 EIA Regulations requires the Planning Inspectorate to notify other European Economic Area (EEA) States and publicise an application for development consent if it is of the view that the proposed development is likely to have significant effects on the environment of another EEA Member State, and where relevant to consult with the EEA State affected.

1.3.51 The *Environmental Statement* considers the potential for transboundary effects in Vol 2 Section 2.4, and in Vol 2 Appendix O. The consideration takes into account inter-relationships between any effects, and cumulative effects, where necessary.

Policy guidance in the National Policy Statement for Waste Water

1.3.52 Part 3 of the NPS sets out certain general policies, in accordance with which applications relating to waste water infrastructure are to be decided, that do not relate only to the particular physical impacts of its construction or operation (see para. 1.3.53, below). These are general factors for examination and determination of applications for nationally significant waste water infrastructure. A summary of these general policy information details is presented in Vol 1 Table 1.3.2. The table also includes the location where the general policy guidance is addressed in the *Environmental Statement*.

Vol 1 Table 1.3.2 NPS - EIA factors for examination and determination of applications

NPS section	General policy guidance	Location within *ES*
3.2.1	Ensure that likely significant effects at all stages of the project have been adequately assessed	Construction and operational effects sections are included in: Vol 3 Project-wide effects assessment Vols 4 to 27 (site effects assessments)
3.2.2	Provide information on the likely significant social and economic effects of the development, and shows how any likely	Vol 3 Project-wide effects assessment Section 10

NPS section	General policy guidance	Location within *ES*
	significant negative effects would be avoided or mitigated	Vols 4 to 27 (site assessments) Section 10
3.2.3	When considering cumulative effects, the Environmental Statement should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence)	Cumulative effects sections are included in: Vol 3 Project-wide effects assessment Sections 4 to 15 Vols 4 to 27 (site assessments) Sections 4 to 15
3.2.4	Consider how the accumulation of, and interrelationship between, effects might affect the environment, economy or community as a whole	Cumulative effects sections are included in: Vol 3 Project-wide effects assessment Sections 4 to 15 Vols 4 to 27 (site assessments) Sections 4 to 15
3.2.7	Where some details are still to be finalised, the Environmental Statement should set out, to the best of the applicant's knowledge, what the maximum extent of the proposed development may be in terms of site and plant specifications, and assess, on that basis, the effects which the project could have to ensure that the impacts of the project as it may be constructed have been properly assessed	Vol 3 Project-wide effects assessment Section 3 Vols 4 to 27 (site assessments) Section 3
3.3	Habitat Regulations Assessment	A separate *Habitat Regulations Assessment: No Significant Effects Report* accompanies the application
3.4.3	The Environmental Statement should include an outline of the main alternatives studied and an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects	This volume, Section 3 Vols 4 to 27 (site assessments) Section 3.6
3.5	Good design considerations	Section 8.3 of the *Planning Statement*, which accompanies the

NPS section	General policy guidance	Location within *ES*
		application
3.6.6	The Environmental Statement should set out how the proposal will take account of the projected impacts of climate change.	This volume, paras. 1.3.13 to 1.3.20.
3.6.8	The proposals should take into account the potential impacts of climate change using the latest UK Climate Projections available at the time the Environmental Statement was prepared	This volume, paras. 1.3.13 to 1.3.20.
3.7	Pollution control and other environmental consenting regime considerations	This volume, paras. 1.3.57 to 1.3.67.
3.8	Health and safety considerations	*Code of Construction Practice* Part A (this document, Appendix A – Sections 3, 4, 6, 7, 9, and 10)
3.9	Hazardous substance considerations	*Code of Construction Practice* Part A (this document, Appendix A, Section 4.9 and 4.10)
3.10.5	The applicant should identify any significant adverse health impacts in the Environmental Statement, and identify measures to avoid, reduce or compensate for these impacts as appropriate	A separate *Health Impact Assessment* accompanies the application
3.11	Common law nuisance and statutory nuisance considerations	A separate *Statement in Respect of Statutory Nuisance* accompanies the application
3.12	Security considerations	*Code of Construction Practice* Part A (this document, Appendix A, Section 4.8)

1.3.53 Part 4 of the NPS contains policies relating to particular physical impacts relevant to the construction or operation of nationally significant waste water infrastructure projects. The list of impacts covers the most significant issues and those which arise most frequently, and are relevant to any waste water infrastructure project. They are presented in Vol 1 Table 1.3.3, below. The table also includes the location where the generic impacts policy guidance is addressed in the *Environmental Statement*.

Vol 1 Table 1.3.3 NPS - generic impact requirements

NPS section	Generic impacts policy guidance	Location within the *Environmental Statement*
4.2	Water quality and resources	Vol 2 Environmental assessment methodology Sections 13 and 14* Vol 3 Project-wide effects assessment Sections 13 and 14 Vols 4 to 27 (site assessments) Sections 13 and 14
4.3	Odour	Vol 2 Environmental assessment methodology Section 4* Vol 3 Project-wide effects assessment Section 4; Vols 4 to 27 (site assessments) Section 4
4.4	Flood risk	Vol 2 Environmental assessment methodology Section 15* Vol 3 Project-wide effects assessment Section 15 Vols 4 to 27 (site assessments) Section 15
4.5	Biodiversity and geological conservation[ix]	Vol 2 Environmental assessment methodology Sections 5 and 6 Vol 3 Project-wide effects assessment Sections 5and 6 Vols 4 to 27 (site assessments) Sections 5 and 6
4.6	Coastal change	Vol 2 Environmental assessment methodology Sections 5 and 14* Vol 3 Project-wide effects assessment Sections 5 and 14 Vols 4 to 27 (site assessments) Sections 5 and 14
4.7	Landscape and visual impacts	Vol 2 Environmental assessment methodology Section 11* Vol 3 Project-wide effects assessment Sections 5 and 11 Vols 4 to 27 (site assessments) Section 11
4.8	Land use, including open space, green infrastructure and green belt	A separate *Open Space Assessment* accompanies the application
4.9	Noise and vibration	Vol 2 Environmental assessment methodology Section 9* Vol 3 Project-wide effects assessment Section 9 Vols 4 to 27 (site assessments) Section 9
4.10	Historic environment	Vol 2 Environmental assessment methodology Section 7*

[ix] There are no areas of geological conservation in the project area, therefore this factor has not been assessed in the *Environmental Statement*

NPS section	Generic impacts policy guidance	Location within the *Environmental Statement*
		Vol 3 Project-wide effects assessment, Section 7 Vols 4 to 27 (site assessments) Section 7 (see also the *Heritage Statement*, which accompanies the application, which provides standalone historic environment plans and report)
4.11	Air quality and emissions	Vol 2 Environmental assessment methodology Section 4* Vol 3 Project-wide effects assessment, Section 4 Vols 4 to 27 (site assessments) Section 4
4.12	Impacts associated with:	
	Dust	Vol 2 Environmental assessment methodology Section 4* Vol 3 Project-wide effects assessment, Sections 4 Vols 4 to 27 (site assessments) Section 4
	Artificial light	Vol 2 Environmental assessment methodology Sections 5, 6 and 11 Vol 3 Project-wide effects assessment Sections 5, 6 and 11 Vols 4 to 27 (site assessments) Sections 5, 6 and 11
	Smoke and steam Insect infestation (Note: Vermin have also been considered)	Not applicable [x]
4.13	Traffic and transport	Vol 2 Environmental assessment methodology Section 12* Vol 3 Project-wide effects assessment, Section 12 Vols 4 to 27 (site assessments) Section 12
4.14	Waste management	Assessed throughout the *Environmental Statement* (see Vol 1 Plate 1.3.1).
4.15	Socio-economic	Vol 2 Environmental assessment methodology Section 10* Vol 3 Project-wide effects assessment, Section 10 Vols 4 to 27 (site assessments) Section 10

** how the detailed requirements of these NPS generic impacts have been addressed in the Environmental Statement, and the locations for further details, are explained fully within these sections in Vol 2 Environmental assessment methodology.*

[x] the Thames Tideway Tunnel project is not the same as other waste water infrastructure projects such as Sewage Treatment Works where effluent is stored in tanks and insect infestation may be a more significant issue. Whilst not explicitly noted in NPS para. 4.12, potential vermin issues have been considered by the project, and the proposed management and controls for public health issues during construction are reported in the *Code of Construction Practice*, Section 4.3 (Vol1 Appendix A).

Requirements and controls

1.3.54 Schedule 3 of the *Draft DCO* contains the proposed Requirements that would be imposed on the *DCO* if it were confirmed. These have been developed in consultation with the local authorities and other stakeholders.

1.3.55 The commitment to the design principles and parameters for individual works is secured through the *DCO* Requirements. The proposed Requirements secure commitment to various strategies submitted with the application, and also secure the mitigation measures identified in the *Environmental Statement*.

1.3.56 The proposed Requirements provide a robust framework of control to ensure the project is implemented in accordance with the principles, parameters and strategies enshrined within the application documents.

Other consents

1.3.57 The consents required to construct, operate and maintain the project have been identified.

1.3.58 The *Draft DCO* contains, in so far as possible, all consents and powers required to construct, operate and maintain the project.

1.3.59 There are however some additional consents and licences that are required to deliver the project that cannot at present be included in the *Draft DCO* as Thames Water does not have the formal consent of the normal consenting body to do so.

1.3.60 Detailed information on legislation and other consents relevant to each environmental assessment topic is included in the legislation and guidance sections of the topic assessment methodologies (Sections 4 to 15) presented in Vol 2 of the *Environmental Statement*.

1.3.61 Consents normally obtained from the Environment Agency concerning new works that perform a flood protection function and other structures (not performing a flood protection function) within 16m of a main river; and protected species licences normally issued by Natural England. At present there in no requirement for protected species licences in respect of the project. If that were to change then the obtaining of those licences would be dealt with through the normal consenting process.

1.3.62 Thames Water has sought to make progress with securing the consents that are required from the Environment Agency, and has engaged in discussions with them. The expectation is that a protective provision in favour of the Environment Agency will be included within the *Draft DCO*, and in return the Environment Agency will agree to the consent normally issued by them, being included within the *Draft DCO*. In connection with this process various matters are being included within a statement of common ground between the Environment Agency and Thames Water. As with other negotiations the process is positive and the Environment Agency is engaged. There is no reason to suggest the Environment Agency consent will not be forthcoming.

1.3.63 Finally there are a number of consents which will be left to the contractor employed to construct the project to obtain. This is because the contractor

is best placed to provide the information needed to secure the consent that is necessary. A number of these additional consents are procedural, in as much as a there is a requirement that they be obtained but that in practice the obtaining of them is as a matter of process or compliance rather than principle. There is no reason to suggest these consents will not be forthcoming. In a number of instances consents that might normally be required have been disapplied in the *Draft DCO* in order to reduce the administrative burden on the normal consenting authority and the contractors and on the basis that the provision of the *Draft DCO* including the Requirements mean that amenity and the environment generally will not be prejudiced by disapplication of the normal consenting regime. An example of this is the requirement to obtain licences or hoardings on public highways.

Tideway Tunnel Operating Agreement

1.3.64 As part of the Lee Tunnel project, a new CSO will be constructed at Beckton Sewage Treatment works, known as the Tideway CSO. This CSO requires an Environmental Permit to be obtained from the Environment Agency. Once the Thames Tideway Tunnel and associated connection tunnels are completed, they would be connected to the Lee Tunnel. The two tunnel systems would then be linked and referred to as the London Tideway Tunnels. Management of the flows collected by the London Tideway Tunnels would necessitate a storm overflow from the tunnels, which would discharge to the tidal Thames via the Tideway CSO at Beckton Sewage Treatment Works.

1.3.65 Operating Techniques for the management of the Lee Tunnel have been agreed between the Environment Agency and Thames Water. These techniques form a key element of the Permit for the Tideway CSO.

1.3.66 Following connection of the Thames Tideway Tunnel and associated infrastructure the operation of the Tideway CSO would change, and new Operating Techniques would apply. The *London Tideway Tunnels Operating Techniques relating to the Tideway Combined Sewer Overflow (CSO) and the Actively Managed CSOs to the tidal Thames* were agreed between Thames Water and the Environment Agency on 8 November 2012. This document describes the principles of how the London Tideway Tunnels would be operated to limit CSO discharges into the tidal Thames, including from the Tideway CSO (see Volume 3 Appendix L.1 of the *Environmental Statement* for information on CSO control and performance of the Thames Tideway Tunnel).

1.3.67 The Environment Agency and Thames Water are currently in discussions regarding agreeing the Permit. The Permit shall be written in such a way that on commissioning the London Tideway Tunnels, the agreed Operating Techniques shall take effect.

1.4 Summary of EIA approach

1.4.1 Detailed information on the environmental assessment methodology used to prepare the *Environmental Statement* is presented in Vol 2.

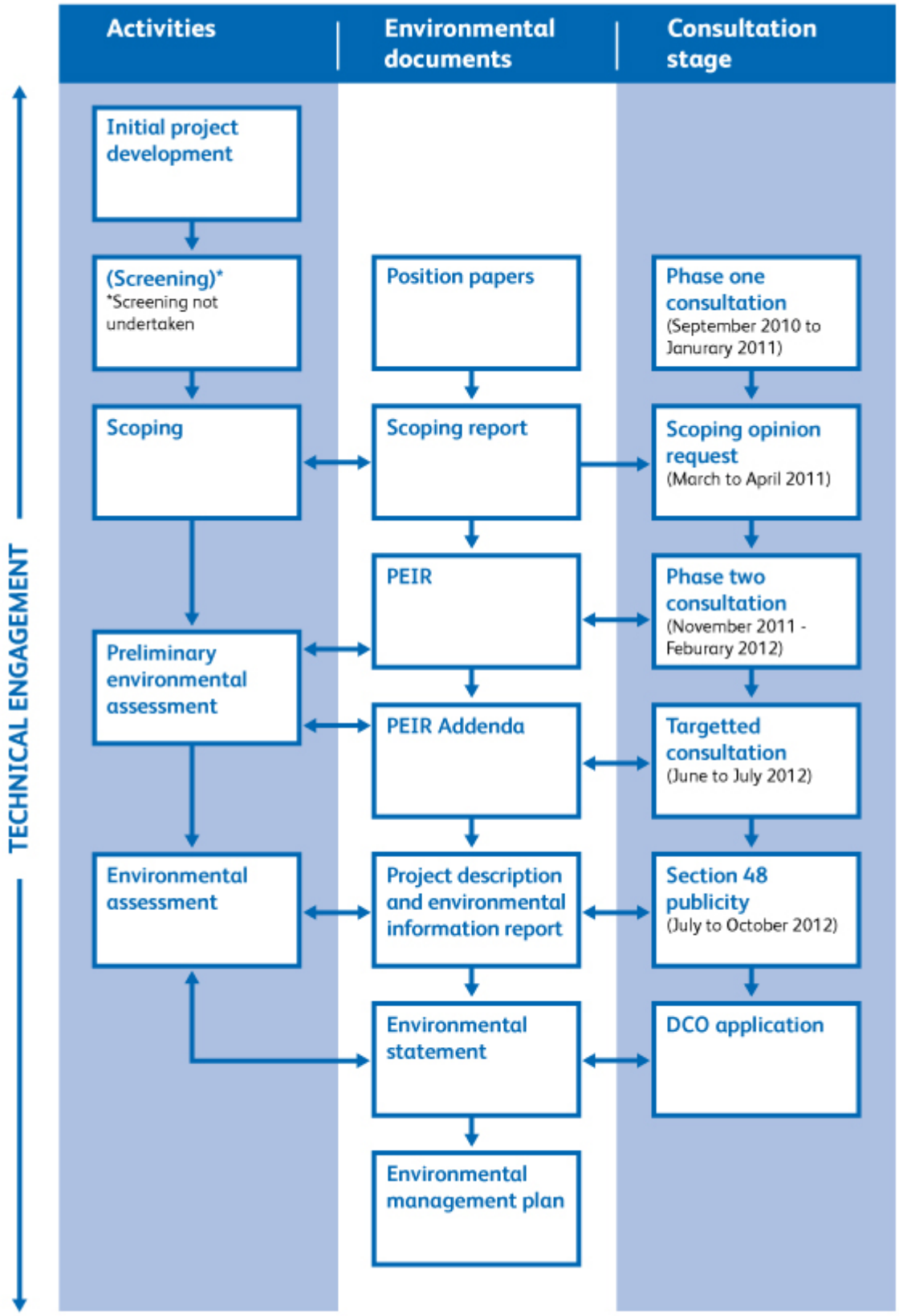
1.4.2 Consistent terminology is used through the *Environmental Statement* wherever possible. An explanation of the more important terminology used is provided within Vol 2 Section 3.

1.4.3 The various terms and abbreviations used throughout the *Environmental Statement* are included in the glossary and abbreviations document.

Overview of the EIA process

1.4.4 EIA is in part a sequential process and in part an iterative process. Vol 1 Plate 1.4.1 illustrates the general sequential EIA process applied to the Thames Tideway Tunnel project.

Vol 1 Plate 1.4.1 EIA process for Thames Tideway Tunnel project



1.4.5 Extensive technical engagement has been undertaken during the EIA process, including on the *Preliminary environmental information report*[xi] (Thames Water, 2011)[5]. Detailed information on the forms of engagement, purpose, frequency and stakeholders that attended is provided in Vol 2 Section 2.9, and also within the accompanying 'engagement' sub-sections of the topic assessment methodologies.

Effects assessment

1.4.6 Each of the effects assessments provide information on:

a. the site context (Vol 3 provides a project-wide context)

b. the proposed development

c. the topic assessments.

1.4.7 The nature of this information and how it informs the EIA approach is set out below. A detailed explanation of the general methodology for effects assessment is provided in Volume 2, Section 3.7.

The site context

1.4.8 Each of the effects assessments provide an overview of the site location, boundary, existing access, surrounding receptors, and environmental designations.

The proposed development

1.4.9 For each of the effects assessments undertaken (Vol 3 Project-wide effects assessment, and Vol 4 to 27, the site assessment volumes) the proposed development being assessed is described using the following types of information:

a. overview of the proposed development

b. the defined project

c. construction assumptions

d. operational assumptions

e. base case and cumulative development

f. on-site alternatives.

Overview of the proposed development

1.4.10 Each effects assessment provides a short introductory summary of the substantive elements of the proposed development, and the contents of the proposed development description.

The defined project

1.4.11 The defined project information is located in each of the effects assessment volumes (Vols 3 to 27 Section 3.2). The following information is presented:

[xi] The EIA process has progressed considerably since the publication of the *Preliminary environmental information report* and the *PEIR* has effectively been superseded by this Environmental Statement. The PEIR is nevertheless available on the Thames Tideway Tunnel consultation website.

a. application documents and plans defining the proposed development
b. description of the proposed works
c. design principles
d. site features and landscaping, where relevant
e. *CoCP* measures.

Application documents and plans defining the proposed development

1.4.12 Each assessment volume includes a summary table (in Vols 3 to 27 Section 3.2) with information on those plans of the proposals for which consent is sought and which can be regarded, subject to approval, as being "certain" or nearly so (eg indicative locations).

1.4.13 For the tunnel alignment plans, a 'spatial parameters' approach has been used. Within these parameters, infrastructure may be located anywhere within 'limits of deviation', and a similar approach has been adopted in assessing likely significant effects if the alignment moves during detailed design but within the limit of deviation given on the plans.

1.4.14 The level of detail provided on the plans will vary across each of the sites. For each site parameters for zones are defined within which the works will be carried out. For the site works parameter plans, a 'spatial parameters' approach has been used. Subject to the site specific design principles, infrastructure may be located anywhere within its defined parameter. The purpose of this approach is to enable reasonable flexibility during detailed design, whilst ensuring that the maximum extent of the proposed development is considered and that the effects of the project as it may be constructed have been properly assessed.

1.4.15 The parameters have been taken into account in the assessment to ensure that topic effects would not be greater if these elements of the proposed development were configured elsewhere within the defined parameter zones for the site. This is in line with Planning Inspectorate advice in respect to the 'Rochdale envelope'[6].

1.4.16 The above approach allows a degree of flexibility in order to enable:

a. the contractor to use a selected methodology, plant and equipment, based on the contractor's experience and expertise, in order to construct the works as efficiently and safely as possible
b. development of works designs and methodologies based on further design development, more detailed site and geological information available at the time of construction or in response to unforeseen circumstances
c. sites to be arranged to respond to surrounding land uses at the time of construction in order to minimise disruption and nuisance.

1.4.17 Within the *Environmental Statement* these plans are located in the various volumes of figures (Section 1 Plans from the *Book of Plans*) that accompany each of the effects assessment volumes (Vols 3 to 27).

Description of the proposed works

1.4.18 Each effects assessment includes information on the proposed works (Schedule 1 to the *Draft DCO*) (in Vols 3 to 27 Section 3.2). This is the description of the works for which development consent is sought. The proposed works presented in the *Environmental Statement* provide the relevant extracts under three headings, which follow the sections within the schedule, namely:

a. Nationally significant infrastructure project

b. Associated development

c. Ancillary works.

Design principles

1.4.19 The design principles form an integral part of the project and are assumed to be implemented within the design of the operational development. Where individual principles are relevant to a particular topic, this is indicated within the relevant topic assessments.

1.4.20 The design principles for the project have been developed with stakeholders and set the parameters that must be met in the final detailed design of the above-ground structures and spaces associated with the project. The principles apply only to the operational phase of the project (ie, the permanent structures).

1.4.21 The generic principles that are applicable for each assessment are described where necessary (in Vols 3 to 27 Section 3.2). The site-specific principles that apply for a particular site assessment are also provided in Appendix B.

Site features and landscaping

1.4.22 Information on the defined project being assessed also includes a summary of the relevant site features and landscape proposal plans where relevant (in Vols 3 to 27 Section 3.2).

1.4.23 Where necessary, within the *Environmental Statement* the site features and landscaping plans are located in the volumes of figures that accompany the site assessment volumes (Vols 4 – 27, volumes of figures Section 1 Plans from the *Book of Plans*).

Code of Construction Practice

1.4.24 Each assessment reiterates that all works would be undertaken in accordance with the *Code of Construction Practice (CoCP)*. The *CoCP* sets out a series of measures to protect the environment and limit disturbance from construction activities as far as reasonably practicable. These measures would be applied throughout the construction process, and would be the responsibility of the contractor to implement. The *CoCP* comprises two parts, Part A and Part B. Part A presents measures which are applicable at all sites across the project and Part B defines measures which are only applicable at individual sites.

1.4.25 The *CoCP* forms an integral part of the project and all of the measures contained therein are assumed to be in place during the construction processes described in the environmental assessments. Further details

on the measures within the *CoCP* at any particular site are given within Appendix A.

Construction assumptions

1.4.26 Information on construction assumptions is located in each of the effects assessment volumes (Vols 3 to 27 Section 3.3).

1.4.27 The approach to construction which has been assumed for the purposes of the EIA is described within each of effects assessments. The illustrative construction programme, layouts and working methods are provided.

1.4.28 The illustrative programme, layouts and working methods described represent what is considered to be the likely approach, given the existing site constraints, the adjacent land uses and the construction requirements. The construction assumptions in each effects assessment provide information on the main activities, with a focus on those that are relevant for the assessment of environmental effects.

1.4.29 Whilst the application is for a standalone project that has considered other developers schemes and activities in the project design and environmental assessment, areas for potential collaboration (eg, shared use of jetties, lorry holding areas, power supplies) with neighbouring developments are actively being sought by Thames Water. It is intended that any potential collaboration would be agreed prior to commencement of the project works.

Operational assumptions

1.4.30 Information on the operational assumptions is provided in each of the effects assessment volumes (Vols 3 to 27 Section 3.4).

1.4.31 The details given are considered to represent the likely approach, given the site constraints, the adjacent land uses and the operational requirements. The information provided describes only the main operational structures and activities with the focus on those that are relevant for the assessment of environmental effects.

1.4.32 The information includes descriptions of the operational structures and the assumed maintenance regime.

The topic assessments

Legislation and guidance

1.4.33 The *Environmental Statement* has been produced with regard to the statutory framework for EIA summarised in Section 1.3, and to relevant best practice guidance, including but not limited to the following. In some instances, guidance and legislation has been updated since it was used at the time, such as the *Infrastructure Planning Commission's Advice Note 7.*

a. *Planning Act* 2008[7] (as amended by the Marine and Coastal Access Act 2009 and the Localism Act 2011)

b. Infrastructure Planning (Environmental Impact Assessment) Regulations 2009[8] (as amended by the Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations 2012[9]).

c. Waste Water National Policy Statement (NPS) (designated March 2012)[10]

d. Infrastructure Planning (Waste Water Transfer and Storage) Order 2012[11]

e. National Planning Policy Framework[12]

f. Department of Communities and Local Government (DCLG*) Circular 02/1999 Environmental Impact Assessment*[13]

g. DCLG Circular 01/2006 Guidance on Changes to the Development Control System[14]

h. DCLG amended *Circular on Environmental Impact Assessment* (consultation paper, June 2006)[15]

i. DCLG Environmental Impact Assessment: A guide to good practice and procedures (consultation paper, June 2006)[16]

j. *Guidance on EIA Scoping* (European Commission, June 2001)[17]

k. Planning Inspectorate, Advice note 3: EIA notification and consultation, version 4 (May 2012)[18]

l. Planning Inspectorate, Advice note 6: Preparation and submission of application documents, version 5 (June 2012)[19]

m. Planning Inspectorate, Advice note 7: Environmental Impact Assessment, screening and scoping, version 3 (April 2012)[20]

n. Planning Inspectorate, *Advice note 9: Using the 'Rochdale Envelope*', version 2 (April 2012)[21]

o. Planning Inspectorate, Advice note 12: Development with significant transboundary impacts consultation, version 3 (April 2012)[22]

p. Planning Inspectorate, Advice note 14: Compiling the consultation report, version 2 (April 2012)[23]

q. EA Scoping guidelines for the Environmental Impact Assessment of Projects, (May 2002)[24]

r. Institute of Environmental Management and Assessment (IEMA), *Guidelines for Environmental Impact Assessment* (2004)[25].

s. European Commission, *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions* (1999)[26].

1.4.34 Where relevant, topic specific guidelines are referred to within the topic specific assessment methodology sections (Vol 2 Section 4 to 15).

Baseline

1.4.35 Prior to undertaking the impact assessments for each topic the current environmental conditions have been identified. This is known as identifying the baseline. A wide range of information about the existing environment has been obtained from observations made on-site, field surveys, information provided by stakeholders and desk based information. This allows the existing environmental resources present to be identified and evaluated.

1.4.36 Detailed information on the methods used to identify the baseline is provided in Vol 2 Section 3.3, and the accompanying baseline sub-sections of the topic assessment methodologies (Vol 2 Section 4 to 15).

Base case and assessment cases

1.4.37 The EIA considers the likely significant environmental effects associated with the Thames Tideway Tunnel project and does this against a future baseline. Whilst existing baseline data form a 'current baseline', it is important within the EIA to consider how the environment is likely to change, in any event, in the absence of the project. For example, traffic levels typically increase year-on-year. This 'future baseline' is described as the 'base case' in the rest of this assessment. It represents a 'do nothing' or 'without the Thames Tideway Tunnel project' scenario.

1.4.38 The Thames Tideway Tunnel project has been assessed against the base case, both for construction and operation, for particular assessment years.

1.4.39 The identification of new development proposals relevant to the base case has been carried out during the course of the assessment and in particular during a review of relevant schemes as part of the cumulative effects assessment.

1.4.40 Detailed information on the methods used to identify the base case and assessment cases is provided in Vol 2 Section 3.4, and the accompanying 'baseline data collection' sub-sections of the topic assessment methodologies (Vol 2 Section 4 to 15).

Temporal scope and assessment years

1.4.41 Each assessment establishes when, during the construction and operational periods, significant environmental effects are most likely to happen. The selected assessment years for each site and for the project-wide assessment, and for each topic, have been identified utilising best practice guidance, professional judgement and discussions with statutory stakeholders.

1.4.42 The temporal scope of the assessment varies from topic to topic.

1.4.43 Detailed information on the methods used to identify the temporal scope and assessment years is provided in Vol 2 Section 3.5, and also the accompanying 'assessment years' sub-sections of the topic assessment methodologies (Vol 2 Section 4 to 15).

Spatial scope of assessment

1.4.44 The spatial scope of each assessment is defined, being the area over which changes to the environment are likely to occur as a result of the proposed development. The spatial scope of the assessment varies between topics by virtue of the different types of impacts, and resources and receptors.

1.4.45 In terms of identifying base case and cumulative effects, information within 1km has generally been collected, as set out in Vol 2 Section 3.8.

1.4.46 Detailed information on the methods used to identify the spatial scope is provided in Vol 2 Section 3.6, and also the accompanying 'assessment

areas' sub-sections of the topic assessment methodologies (Vol 2 Section 4 to 15).

Assessment of effects

Types of effects assessed

1.4.47 The *2009 EIA Regulations* require the *Environmental Statement* to report on a number of different types of effects including direct, indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary, positive and negative[xii]. All of these types of effects are assessed within the topic assessments, describing effects for construction and operation, and site-specific and project-wide levels.

Assessing significance

1.4.48 Each topic assessment considers the significance of likely effects. The level of significance of an effect is commonly derived from combining measures evaluating the magnitude of impact and the value and sensitivity of the receptors affected.

1.4.49 In order to allow comparison of effects to be made across the extent of the project and to allow a robust assessment of project-wide effects to be clearly understood, a series of generic significance criteria descriptors has been developed in the form of a significance matrix as shown in Vol 1 Table 1.4.1 below.

1.4.50 For most topics, the significance of effects has been determined by combining the identified impact magnitude, with the receptors affected by those impacts, taking into account their value and sensitivity as set out in Vol 1 Table 1.4.1.

1.4.51 As a general principle, and subject to professional judgement, moderate and major effects are deemed significant, whilst minor and negligible effects are deemed non-significant.

[xii] how these terms have been interpreted in the *Environmental Statement* is explained in Vol 2 Environmental assessment methodology

Vol 1 Table 1.4.1 Generic significance matrix

		Receptor value/sensitivity		
		High	**Medium**	**Low**
Impact magnitude	High	Major adverse / beneficial	Major adverse / beneficial	Moderate adverse / beneficial
	Medium	Major adverse / beneficial	Moderate adverse / beneficial	Minor adverse / beneficial
	Low	Moderate adverse / beneficial	Minor adverse / beneficial	Negligible effect
	Negligible	Minor adverse / beneficial	Negligible effect	Negligible effect

1.4.52 Detailed information on the methods used to assess effects is provided in Vol 2 Section 3.7, and also the accompanying 'assessment of effects' sub-sections of the topic assessment methodologies (Vol 2 Section 4 to 15).

Cumulative effects

1.4.53 Each topic assessment considers cumulative effects. For this project, cumulative effects are defined as those that arise from the Thames Tideway Tunnel with other non-Thames Tideway Tunnel projects.

1.4.54 Information has been collected on developments within a 1km radius of each Thames Tideway Tunnel project site and the assessments have considered developments of relevance. The developments for assessment have been differentiated into those to be assessed as part of the 'base case' (ie, future year 'without Thames Tideway Tunnel project' scenario) and those assessed as part of the cumulative effects assessment.

1.4.55 The assessment of cumulative effects considers those developments that are programmed to be under construction or operational at the same time as the Thames Tideway Tunnel project.

1.4.56 Development schedules have been produced for each Thames Tideway Tunnel project site. It is possible that a phased development project would be considered as both base case and cumulative. In such cases the completed part of a development (in a given assessment year) would be considered as base case, while the part of the development under construction would be assessed in the cumulative effects assessment.

1.4.57 Detailed information on the methods used to assess cumulative effects is provided in Vol 2 Section 3.8, and also the accompanying 'assessment of effects' sub-sections of the topic assessment methodologies (Vol 2 Section 4 to 15).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.01**

Volume 1: Introduction to the Environmental Statement

Summary of proposed development

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

Hard copy available in

Box **15** Folder **A**
January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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2 Summary of proposed development

2.1 Introduction

2.1.1 Part 1 of Schedule 4 of 2009 EIA Regulations requires that an environmental statement must include a description of the development. This section provides a summary description of the Thames Tideway Tunnel project. Detailed descriptions of the proposed development are provided in the environmental effects assessment volumes (the project-wide effects assessment in Vol 3 Section 3, and the site effects assessments presented in Vols 4 to 27, Section 3).

2.1.2 Following this introduction, Section 2.2 provides a project-wide development summary, including information on:

a. the main tunnel
b. the long connection tunnels
c. the short connection tunnels
d. tunnel drive strategy
e. tunnel construction activities
f. permanent tunnel infrastructure
g. tunnel operation.

2.1.3 Section 2.3 provides a summary of each of the proposed construction sites, including information on:

a. existing uses
b. proposed uses
c. approximate maximum site working area
d. approximate shaft depth (to invert level)
e. approximate shaft internal diameter
f. approximate construction start year and duration
g. construction activities and durations
h. working hours
i. construction transport mode
j. where applicable, peak monthly average barge numbers, and duration of peak
k. peak monthly average lorry numbers, and duration of peak
l. approximate excavated material amount
m. above-ground operational structures - maximum height.

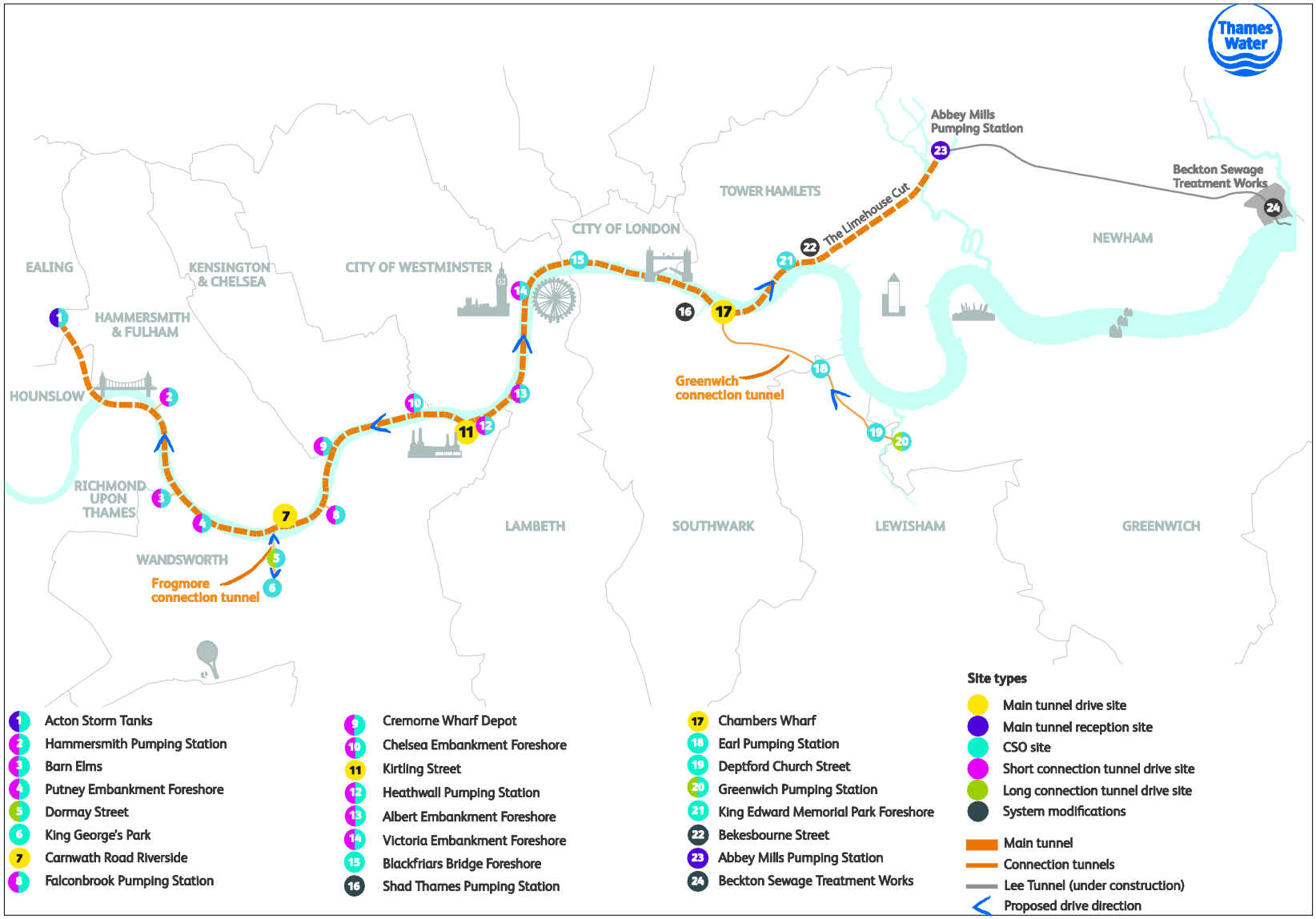
2.2 Proposed development summary – the project (including tunnels)

2.2.1 The following provides summary information on the purpose of the project, including the tunnel infrastructure, together with a description of the tunnel elements, the drive strategy, construction activities, project construction programme and tunnel operation.

2.2.2 The project comprises a wastewater storage and transfer tunnel ('the main tunnel') which would be approximately 25km long, and between 6.5m and 7.2m in internal diameter. The approximate depth of the main tunnel would be between 30m in west London and 65m in east London, broadly following the route of the tidal Thames from west to east. It would run between Thames Water's existing operational sites at Acton Storm Tanks in the west and Abbey Mills Pumping Station in the east where it would connect to the Lee Tunnel currently under construction. The tunnel would capture untreated combined sewage and storm water that currently overflows directly into the tidal Thames from CSOs along its route. The tunnel would then store the captured combined sewage from the CSOs and transfer it, via connection to the Lee Tunnel at Abbey Mills Pumping Station, for treatment at Beckton Sewage Treatment Works bringing long-term benefits for the environment and people using the tidal Thames.

2.2.3 A schematic of the project is presented in Vol 1 Plate 2.2.1.

Vol 1 Plate 2.2.1 Schematic of the Thames Tideway Tunnel project



2.2.4 The project comprises two main elements:

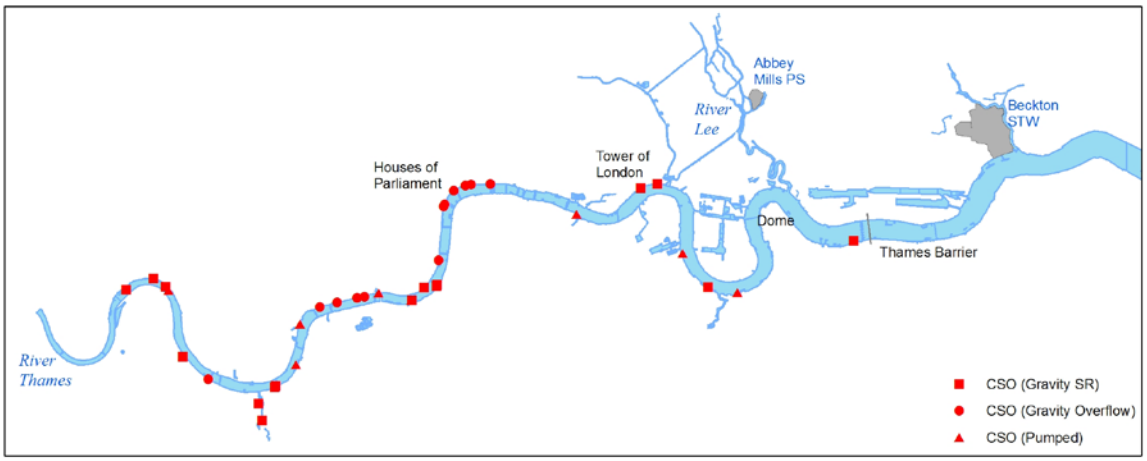
a. tunnels: the main tunnel and connection tunnels that link CSOs to the main tunnel

b. sites: main tunnel shaft sites that are needed to construct the main tunnel; CSO drop shaft and interception sites that are needed to construct the interception works and transfer the controlled flows to the tunnel system and associated connection tunnels; system modification sites to undertake existing sewer system modifications to aid in control of CSOs; and works at Beckton Sewage Treatment Works to receive flows from the tunnel system for treatment.

Summary of project purpose - control of combined sewer overflows

2.2.5 The EA evaluated 57 CSOs and identified 36 of these as unsatisfactory, of which 34 require control through the Thames Tideway Tunnel project (of the remaining two CSOs, one is being controlled by the Lee Tunnel, and one by a separate project at Wick Lane). Vol 1 Plate 2.2.2 shows the 34 CSOs to be controlled by the project.

Vol 1 Plate 2.2.2 Distribution of CSOs to be controlled by the Thames Tideway Tunnel project



2.2.6 Design development has shown that not all of the 34 CSOs would require their own individual CSO interception works in order for them to be adequately controlled. For some CSOs, it would be possible to use existing sewers and pumping station operation modifications to control their overflows. This has the advantage of reducing the number of worksites required. The 34 CSOs would be controlled by the following methods:

a. **Method A:** 15 CSOs would be controlled by diverting their flows into the main tunnel.

b. **Method B:** three other CSOs would also be controlled by diverting their flows into the main tunnel and next to each of these three CSOs a local connection would be made to the existing northern Low Level Sewer No.1 to divert some of its flow into the main tunnel as well.

c. **Method C:** the flows from ten other CSOs would be controlled through the extra capacity in the northern Low Level Sewer No.1 resulting from Method B which would enable it to handle flows from other CSOs without needing to intercept them so that no worksites would be required at these ten CSOs.

d. **Method D:** five CSOs would be controlled through modifications to change the operation of the existing sewerage system, including adjustments to existing pumping stations and local in-sewer modifications that allow flows to be stored and passed forward through the existing sewer system to the sewage treatment works. Only two would require worksites.

e. **Method E:** local in-sewer modification works have been carried out resulting in flows for one CSO already being controlled (these are not part of the proposed development as they have already been carried out).

2.2.7 The flows from the CSOs which are to be directly intercepted, and relevant flows from indirectly controlled CSOs, would be connected to the tunnel system and forwarded for treatment at Beckton Sewage Treatment Works via the Lee Tunnel.

2.2.8 The methods described in para. 2.1.4 and flow control proposals for the 34 unsatisfactory CSOs are listed in the Vol 1 Table 2.2.1.

Vol 1 Table 2.2.1 CSOs, method of flow control, and construction site locations

CSO	Method of flow control	Site
Acton Storm Relief	Interception (Method A)	Main tunnel site: Acton Storm Tanks
Stamford Brook Storm Relief	Control measures at other CSOs would indirectly control this CSO (Method D)	No site required
North West Storm Relief	Control measures at Hammersmith Pumping Station would indirectly control this CSO (Method D)	No site required
Hammersmith Pumping Station	Interception (Method A) and pumping station operation changes	CSO site: Hammersmith Pumping Station
West Putney Storm Relief	Interception (Method A)	CSO site: Barn Elms
Putney Bridge	Interception (Method A)	CSO site: Putney Embankment Foreshore
Frogmore Storm Relief – Bell Lane Creek	Interception (Method A)	CSO site: Dormay Street
Frogmore Storm Relief – Buckhold Road		CSO site: King George's Park

CSO	Method of flow control	Site
Jews Row Wandle Valley Storm Relief Jews Row Falconbrook Storm Relief	Modifications already in place so CSO is already controlled (Method E)	No site required
Falconbrook Pumping Station	Interception (Method A) and pumping station operation changes	CSO site: Falconbrook Pumping Station
Lots Road Pumping Station	Interception (Method A)	CSO site: Cremorne Wharf Depot
Church Street	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Queen Street	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Smith Street – Main Line Smith Street – Storm Relief	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Ranelagh	Interception and connection to the northern Low Level Sewer No. 1 (Method B)	CSO site: Chelsea Embankment Foreshore
Western Pumping Station	Controlled indirectly by connection relief works on the northern Low Level Sewer No.1 at other CSOs (Method C) and possible pumping station operation changes	No site required
Heathwall Pumping Station	Interception (Method A)	CSO site: Heathwall Pumping Station
South West Storm Relief	Interception (Method A)	
Kings Scholars Pond	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Clapham Storm Relief	Interception (Method A)	CSO site: Albert Embankment Foreshore
Brixton Storm Relief	Interception (Method A)	
Grosvenor Ditch	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required

CSO	Method of flow control	Site
Regent Street	Interception via connection to the northern Low Level Sewer No. 1 (Method B)	CSO site: Victoria Embankment Foreshore
Northumberland Street	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Savoy Street	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Norfolk Street	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Essex Street	Controlled indirectly by connection relief works on the northern Low Level Sewer No. 1 at other CSOs (Method C)	No site required
Fleet Main	Interception and connection to the northern Low Level Sewer No. 1 (Method B)	CSO site: Blackfriars Bridge Foreshore
Shad Thames Pumping Station	Pumping station modifications (Method D)	System modification site: Shad Thames Pumping Station
North East Storm Relief	Interception (Method A)	CSO site: King Edward Memorial Park Foreshore
Holloway Storm Relief	Local in-sewer modifications (Method D)	System modification site: Bekesbourne Street
Earl Pumping Station	Interception (Method A)	CSO site: Earl Pumping Station
Deptford Storm Relief	Interception (Method A)	CSO site: Deptford Church Street
Greenwich Pumping Station	Interception (Method A) and pumping station operation changes	CSO site Greenwich Pumping Station
Charlton Storm Relief	Control measures at Greenwich Pumping Station and improvements at Crossness Sewage Treatment Works would control this CSO (Method D)	No site required

2.2.9 The current (based on June 2011 data) CSO annual discharge frequencies and volumes are summarised in Vol 1 Table 2.2.2. The table also presents predicted CSO annual discharge frequencies and volumes, for a typical year in the 2020s, with the London Tideway Improvements in

place (Thames Tideway Tunnel, Lee Tunnel and Sewage Treatment Works improvements).

2.2.10 There are 15 direct interceptions (Method A) with 13 associated CSO shaft construction sites. There are also three construction sites associated with the Method B, and two system modification construction sites (Method D).

Vol 1 Table 2.2.2 Current and predicted CSO discharge frequencies and volumes

Combined sewer overflow	Construction site	Current discharge (June 2011)		Predicted typical year discharge (2020's) with Thames Tideway Tunnel, Lee Tunnel and Sewage Treatment Works improvements[a]	
		Approximate annual frequency	Approximate annual volume (m^3)[b]	Approximate annual frequency	Approximate annual volume (m^3)[b]
Acton Storm Relief	Acton Storm Tanks	29	312,000	0	0
Stamford Brook Storm Relief	No site required	2	500	2	400
North West Storm Relief	No site required	1	2,800	1	600
Hammersmith Pumping Station	Hammersmith Pumping Station	51	2,210,000	1 to 3	104,000
West Putney Storm Relief	Barn Elms	30	34,700	1	1,500
Putney Bridge	Putney Embankment Foreshore	33	68,000	1	1,600
Frogmore Storm Relief – Bell Lane Creek	Dormay Street	32	18,000	1	500
Frogmore Storm Relief – Buckhold Rd	King George's Park	21	86,000	1	1,500
Jews Row Wandle Valley Storm Relief	No site required	1	300	0	0
Jews Row Falconbrook Storm Relief		2	7,400	2	7,600

Combined sewer overflow	Construction site	Current discharge (June 2011)		Predicted typical year discharge (2020's) with Thames Tideway Tunnel, Lee Tunnel and Sewage Treatment Works improvements[a]	
		Approximate annual frequency	Approximate annual volume (m^3)[b]	Approximate annual frequency	Approximate annual volume (m^3)[b]
Falconbrook Pumping Station	Falconbrook Pumping Station	42	709,000	4	45,000
Lots Road Pumping Station	Cremorne Wharf Depot	38	1,140,000	4	92,000
Church Street	No site required	0	0	0	0
Queen Street	No site required	0	0	0	0
Smith Street – Main Line Smith Street – Storm Relief	No site required	4 0	1,400 0	4	1,500
Ranelagh	Chelsea Embankment Foreshore	26	283,000	2	19,000
Western Pumping Station	No site required	37	2,050,000	4	246,000
Heathwall Pumping Station	Heathwall Pumping Station	34	655,000	4	63,000
South West Storm Relief	Heathwall Pumping Station	13	228,000	1	3,900
Kings Scholars Pond	No site required	3	1,400	2	500
Clapham Storm Relief	Albert Embankment Foreshore	6	13,000	1	7,900

Combined sewer overflow	Construction site	Current discharge (June 2011)		Predicted typical year discharge (2020's) with Thames Tideway Tunnel, Lee Tunnel and Sewage Treatment Works improvements[a]	
		Approximate annual frequency	Approximate annual volume (m^3)[b]	Approximate annual frequency	Approximate annual volume (m^3)[b]
Brixton Storm Relief	Albert Embankment Foreshore	29	265,000	1	5,700
Grosvenor Ditch	No site required	3	2,600	2	600
Regent Street	Victoria Embankment Foreshore	5	22,000	0	0
Northumberland Street	No site required	13	72,000	1	300
Savoy Street	No site required	20	8,500	4	800
Norfolk Street	No site required	0	0	0	0
Essex Street	No site required	3	2,100	0	0
Fleet Main	Blackfriars Bridge Foreshore	21	521,000	4	37,000
Shad Thames Pumping Station	Shad Thames Pumping Station	51	92,000	4	72,000
North East Storm Relief	King Edward Memorial Park Foreshore	31	782,000	4	85,000
Holloway Storm Relief	Bekesbourne Street	9	7,900	2	7,000
Earl Pumping Station	Earl Pumping Station	26	539,000	4	51,000

Combined sewer overflow	Construction site	Current discharge (June 2011)		Predicted typical year discharge (2020's) with Thames Tideway Tunnel, Lee Tunnel and Sewage Treatment Works improvements[a]	
		Approximate annual frequency	Approximate annual volume (m^3)[b]	Approximate annual frequency	Approximate annual volume (m^3)[b]
Deptford Storm Relief	Deptford Church Street	36	1,470,000	4	163,000
Greenwich Pumping Station	Greenwich Pumping Station	51	8,320,000	4	573,000
Charlton Storm Relief	No site required	2	600	2	900[d]
TOTAL		56[c]	19,925,200	4[c]	1,592,800

[a] *with London Tideway Improvements in place (Thames Tideway Tunnel, Lee Tunnel and Sewage Treatment Works improvements)*

[b] *individual volumes have been rounded depending on magnitude*

[c] *maximum number for reach of river*

[d] *slight increase in annual discharge volume due to population increase and STW upgrade at Crossness taking STW treatment capacity from approximately 9.0m^3/s to 13m^3/s.*

Proposed tunnel development

Main tunnel

2.2.11 The Abbey Mills route is the proposed main tunnel route and can be seen in the project schematic in Vol 1 Plate 2.2.1.

2.2.12 The main tunnel alignment takes the most cost effective route from Acton Storm Tanks to the tidal Thames and then stays generally beneath the River Thames from west London to Chambers Wharf. It then diverts north easterly towards the Limehouse Cut terminating at the Abbey Mills Pumping Station site where it connects to the Lee Tunnel. The flows from the Thames Tideway Tunnel project and from Abbey Mills Pumping Station are transported through the tunnel system for treatment at Beckton Sewage Treatment Works.

2.2.13 The main tunnel (together with the connection tunnels – see para. 2.2.20, below) would pass under the administrative areas of 14 London local authorities.

2.2.14 The main tunnel would be approximately 25km in length and the approximate depth to the invert of the tunnel would be between 30m in west London and 65m in east London.

2.2.15 The horizontal alignment of the main tunnel would generally follow the tidal Thames where possible, because:

a. it is an efficient route to connect the CSOs that are located on both the north and south banks of the river

b. it would minimise the number of structures that the tunnel would pass beneath, and so reduce the number of third parties affected

c. it would allow the use of the river for construction transport, where practicable and economic.

2.2.16 The vertical alignment of the main tunnel is based on a shallow hydraulic gradient that is designed to provide sufficient clearance to existing tunnels and other facilities under London but also sufficient to maintain self-cleaning velocities in the tunnels.

2.2.17 The geology varies across the route. In the west the tunnel would be principally in London Clay, in the central area between Albert Bridge and Tower Bridge the tunnel would be in the Lambeth group comprising mixed material of gravels, sand and clay, and at the eastern end the tunnel would be in Chalk. The variable geology has informed the location of main tunnel sites and the type of TBM required.

2.2.18 These differences in geology, the location of the tunnel drive and reception sites, and the requirement for construction below the water table, influence the selection of construction techniques and machinery.

2.2.19 The main tunnel drives are summarised in Vol 1 Plate 2.2.1 and Vol 1 Table 2.2.3 (lengths and diameters are approximate). The main tunnel drive strategy has a total of four tunnel boring machines (TBMs).

Vol 1 Table 2.2.3 Main tunnel drives summary

From	To	Length (m)	Internal diameter (m)	Assumed TBM type	Main ground type
Carnwath Road Riverside	Acton Storm Tanks	6950	6.5	Earth pressure balance machine (EPBM)	London Clay
Kirtling Street	Carnwath Road Riverside	5000	7.2	EPBM	London Clay, Lambeth
Kirtling Street	Chambers Wharf	7670	7.2	EPBM	London Clay, Lambeth, Thanet, Chalk
Chambers Wharf	Abbey Mills Pumping Station	5520	7.2	Slurry	Chalk
	Total	25140			

Connection tunnels

2.2.20 Intercepted CSOs would be connected to the main tunnel in three ways:

a. via long connection tunnels which connect with the main tunnel via a shaft (two connection tunnels dealing with five CSOs)

b. via short connection tunnels which connect directly with the main tunnel (nine connection tunnels dealing with 9 CSOs)

c. drop shaft connected directly to the tunnel requiring no connection tunnel (three CSOs).

Long connection tunnels

2.2.21 The long connection tunnels are sufficiently long to be driven by TBM. These tunnels are summarised in Vol 1 Table 2.2.3 and Vol 1 Table 2.2.4 (lengths and diameters are approximate) and connect to the CSO sites listed.

Vol 1 Table 2.2.4 Long connection tunnels drive length summary

From	To	Length (m)	Internal diameter (m)	Assumed TBM type	Main ground type
Frogmore connection tunnel		1120	2.6 to 3.0		
Dormay Street (Frogmore	King George Park	510	2.6 to 3.0	EPBM / open faced	London Clay

From	To	Length (m)	Internal diameter (m)	Assumed TBM type	Main ground type
Buckhold)				shield	
Dormay Street (Bell Lane Creek)	Carnwath Road Riverside	610	2.6 to 3.0	EPBM/ open faced shield	London Clay
Greenwich connection tunnel					
Greenwich (Greenwich, Deptford and Earl)	Chambers Wharf	4610	5.0	Slurry	Chalk

Short connection tunnels

2.2.22 Most CSO drop shafts are connected to the main tunnel by short connection tunnels. The construction methods would depend on the selected contractor's preference and ground conditions, and are anticipated to include the use of sprayed concrete linings (SCL), pipe jacking and segmentally lined tunnels by TBMs. The table below (Vol 1 Table 2.2.5) provides a summary of the short tunnel connections (lengths and diameters are approximate).

Vol 1 Table 2.2.5 Short connection tunnels summary

From	To	Length (m)	Internal diameter (m)	Assumed method	Main ground type
Hammersmith PS (Hammersmith PS)	Main tunnel	300	4.0	SCL/TBM	London Clay
Barn Elms (West Putney)	Main tunnel	220	2.2	Pipe jack or SCL/TBM	London Clay
Putney Bridge (Putney Bridge)	Main tunnel	50	2.2	Pipe jack or SCL/TBM	London Clay
Falconbrook PS (Falconbrook PS)	Main tunnel	260	3.2	SCL/TBM	London Clay
Cremorne Wharf Depot (Lots Road PS)	Main tunnel	190	3.0	Pipe jack or SCL/TBM	London Clay
Chelsea Embankment	Main tunnel	70	4.0	SCL/TBM	London Clay

From	To	Length (m)	Internal diameter (m)	Assumed method	Main ground type
(Ranelagh, Church, Smith Queen and Western PS)					
Heathwall PS (Heathwall PS and SW SR)	Main tunnel	60	4.0	SCL/TBM	Lambeth Group
Albert Embankment (Clapham and Brixton)	Main tunnel	20	3.0	Pipe jack or SCL/TBM	Lambeth Group
Victoria Embankment (Regent, Northumberland, Norfolk and Essex)	Main tunnel	30	3.0	Pipe jack or SCL/TBM	Lambeth Group

2.2.23 The connection tunnels would be driven from the CSO drop shaft. The connection with the main tunnel would then be undertaken after the main tunnel TBM passage. For tunnels in permeable or un-stable ground, ground treatment in the form of dewatering, grouting and freezing may be required.

Tunnel drive strategy

2.2.24 The direction of the tunnel drives is as follows and shown in Vol 1 Plate 2.2.1:

a. main tunnel driven from Carnwath Road Riverside to Acton Storm Tanks

b. Kirtling Street is a double drive site with a drive west to Carnwath Road Riverside and east to Chambers Wharf

c. main tunnel driven from Chambers Wharf to Abbey Mills Pumping Station

d. Greenwich connection tunnel driven from Greenwich Pumping Station to Chambers Wharf

e. Frogmore connection tunnel driven from Dormay Street to King George's Park, and from Dormay Street to Carnwath Road Riverside.

Tunnel construction activities

2.2.25 This section provides a summary of the proposed construction activities associated with the Thames Tideway Tunnel project. Further details regarding construction assumptions, across the project, and at the construction sites, are provided in Vol 3 Section 3.3, and Vols 4 to 27 Section 3.3, respectively.

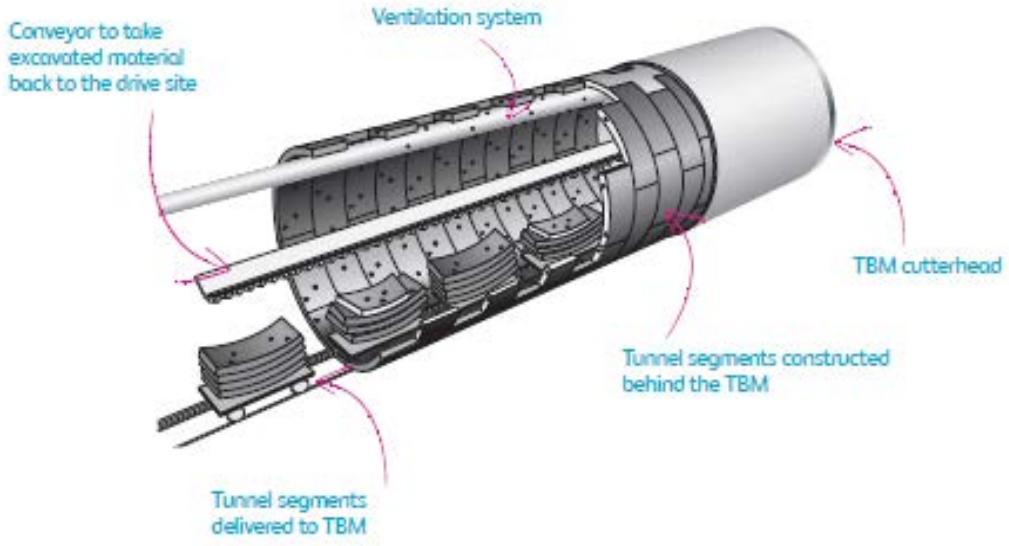
General

2.2.26 The main tunnel and two long connection tunnels would be constructed using tunnel boring machines (TBMs). Shafts would be constructed down to the appropriate depth at both ends of a tunnel. The TBM would start at the shaft known as the 'drive shaft' and would stop at the shaft known as the 'reception shaft'. A shaft may serve as both a drive shaft for one length of tunnel and a reception shaft for another length of tunnel.

2.2.27 The main tunnel drive sites would be major construction sites used to assemble and then drive the TBM, deal with the excavated material from driving the tunnel, and store concrete segments for the primary lining of the main tunnel and deliver these to the TBM via the shaft.

2.2.28 As the tunnel is advanced, excavated material from the face of the TBM would be removed from the tunnel using either a conveyor, a construction railway or hydraulically using a pipeline. After completion of the excavation stage a precast concrete gasketted segmental ring would be erected to form the primary lining. The tunnel lining consists of a set of concrete segments that are erected to form a complete ring and bolted to the lining segments previously assembled. The concrete tunnel 'segments' would be lowered into the shaft by a crane and delivered by a construction train within the tunnel to the TBM. Grout would be injected behind the rings to fill any voids between the concrete segments and the excavated ground surface. The TBM moves forward using hydraulic rams thrusting off this newly assembled tunnel lining. The main elements involved in constructing a tunnel using a TBM are illustrated in Vol 1 Plate 2.2.3, below.

Vol 1 Plate 2.2.3 The elements of constructing a tunnel using a TBM



TBM launch and reception

2.2.29 TBM launch and reception are critical phases of the tunnel construction. In stable, impermeable strata the TBM can mine through a pre-formed tunnel entrance in the shaft as there is no water pressure, nor unstable ground to support.

2.2.30 In pressurised or unstable strata (Lambeth, Thanet Sands and Chalk strata) additional measures would be required as necessary to ensure the stability of the launch and reception works.

2.2.31 These measures can include:

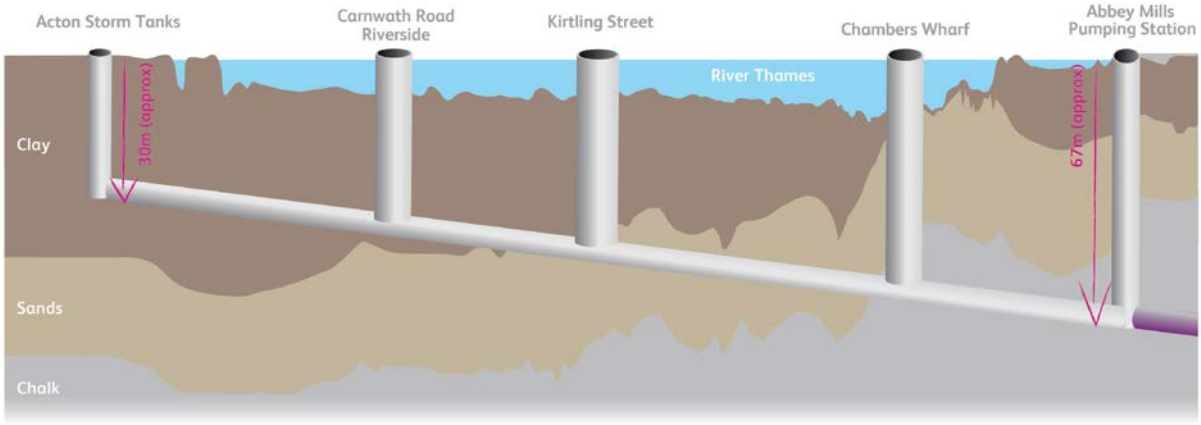
a. dewatering, de-pressurisation and ground improvement immediately adjacent to the shaft

b. sealed launch or reception chambers installed within the shaft to isolate external water pressures

c. fibreglass diaphragm wall reinforcement at tunnel level to assist the launch and reception of TBMs into the shafts.

2.2.32 A schematic of the various strata types and the location of the TBM launch and reception sites is presented in Vol 1 Plate 2.2.4, below.

Vol 1 Plate 2.2.4 Strata types and TBM drive and reception sites



Tunnel secondary linings

2.2.33 The project includes tunnel secondary lining. Secondary lining is an additional layer of concrete placed against the inside face of the tunnel's primary concrete segmental lining. Secondary lining would be constructed by installing reinforcement, erecting a cylindrical shutter within a short length of tunnel, and pumping concrete into the gap between the shutter and the primary lining. Once the concrete has hardened sufficiently, the shutters would be removed and erected in the next stretch of tunnel.

2.2.34 For the main tunnel the secondary lining works would be constructed from the main tunnel drive and reception shafts. For the Greenwich connection tunnel the lining would be constructed from both the Greenwich Pumping Station CSO drop shaft and the Chambers Wharf main tunnel shaft. For the Frogmore connection tunnel the lining would be constructed from the Dormay Street CSO drop shaft. For the short connection tunnels the lining would be constructed from the CSO drop shaft.

2.2.35 The secondary lining work for the main tunnel and Greenwich connection tunnel would be undertaken on a continuous 24 hour a day basis. It is expected that the contractors would provide on-site concrete batching for these sites.

2.2.36 The secondary lining work for the other connection tunnels would be undertaken during standard working hours and are expected to use ready mix concrete from local suppliers, with the sand and aggregates sourced by river or by rail.

Tunnel construction programme

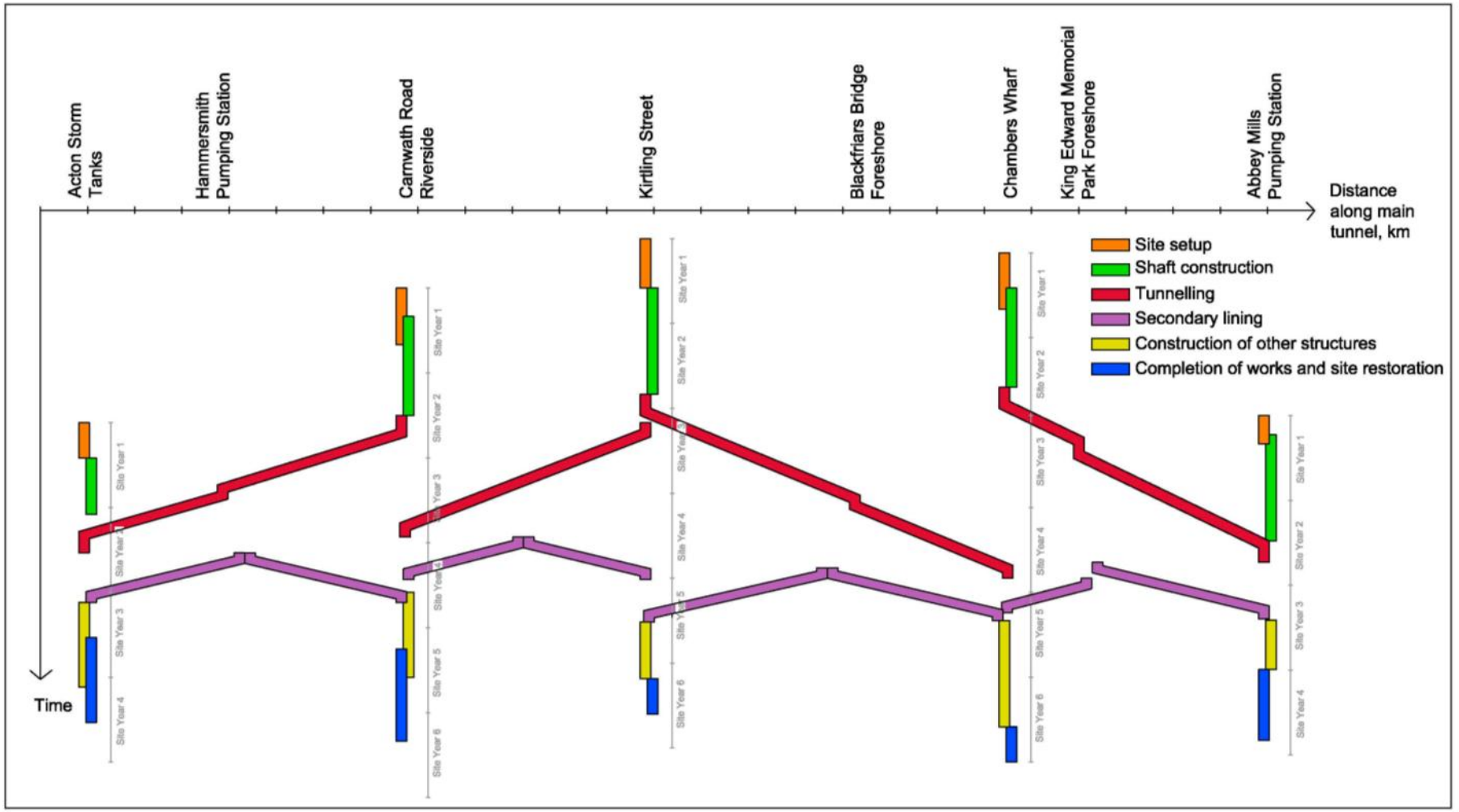
2.2.37 The construction programme, layouts and working methods are illustrative and do not form part of the project for which consent is sought. However they are illustrative of what is considered to be the likely approach, given the existing site constraints, the adjacent land uses and the construction requirements.

2.2.38 The programme for the Thames Tideway Tunnel project is influenced by the UWWTD infraction proceedings and the resultant need for urgent delivery of a tunnel-based solution to resolve the problems in London. The NPS concludes on the need for the Thames Tideway Tunnel by saying that appropriate strategic alternatives to a tunnel have been considered, and it has been concluded that it is the only option to address the problem of discharging unacceptable levels of untreated sewage into the River Thames within a reasonable time at a reasonable cost subject to the requirements of the 2008 Act.

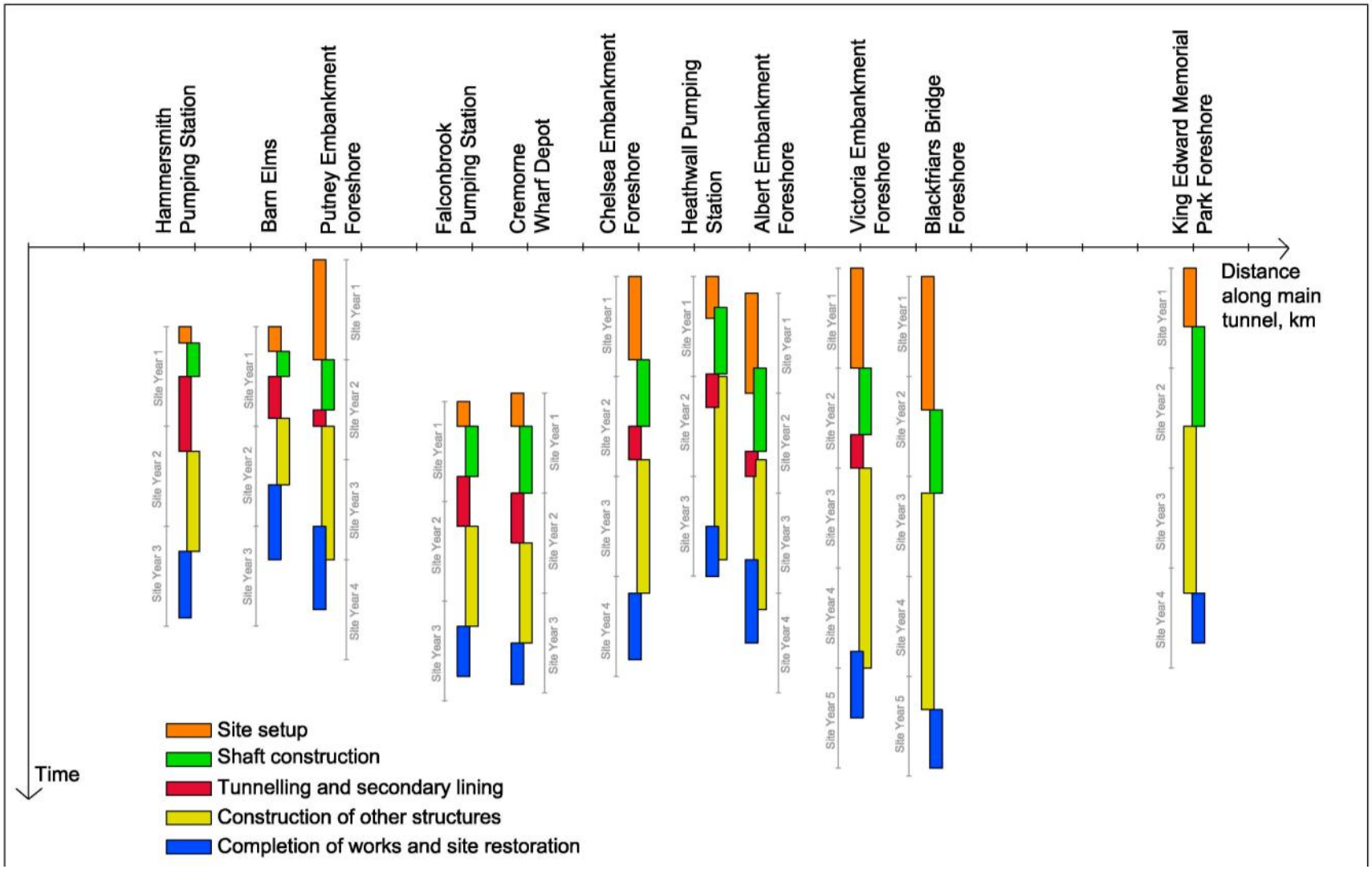
2.2.39 For planning purposes and as a basis for determining environmental impacts, the overall shaft and tunnel construction programme is based on a period of six years, which includes site set-up, shaft construction, tunnelling, secondary lining, construction of other structures, MEICA work and site restoration. To achieve completion in this timeframe there would be simultaneous construction activity within the tunnel and at several sites at any given time over this period.

2.2.40 Vol 1 Plate 2.2.5 to Vol 1 Plate 2.2.8 presents the assumed programme in the form of a ‘time – distance diagram’. In the diagram the horizontal axis represents the distance along the alignment of the tunnel and the vertical axis represents the passage of time. Construction work is then shown as a vertical line when construction is essentially confined to a single site, eg, the vertical lines for Kirtling Street show the assumed durations for site set-up, shaft construction, construction of other structures, MEICA work and site restoration. Construction of the tunnels connecting one site to another are shown as inclined lines indicating the progress between one site and the next. Tunnelling and secondary lining are shown in this way (eg, the lines present the progress of the TBMs driven from Kirtling Street towards Carnwath Road Riverside and Chambers Wharf.

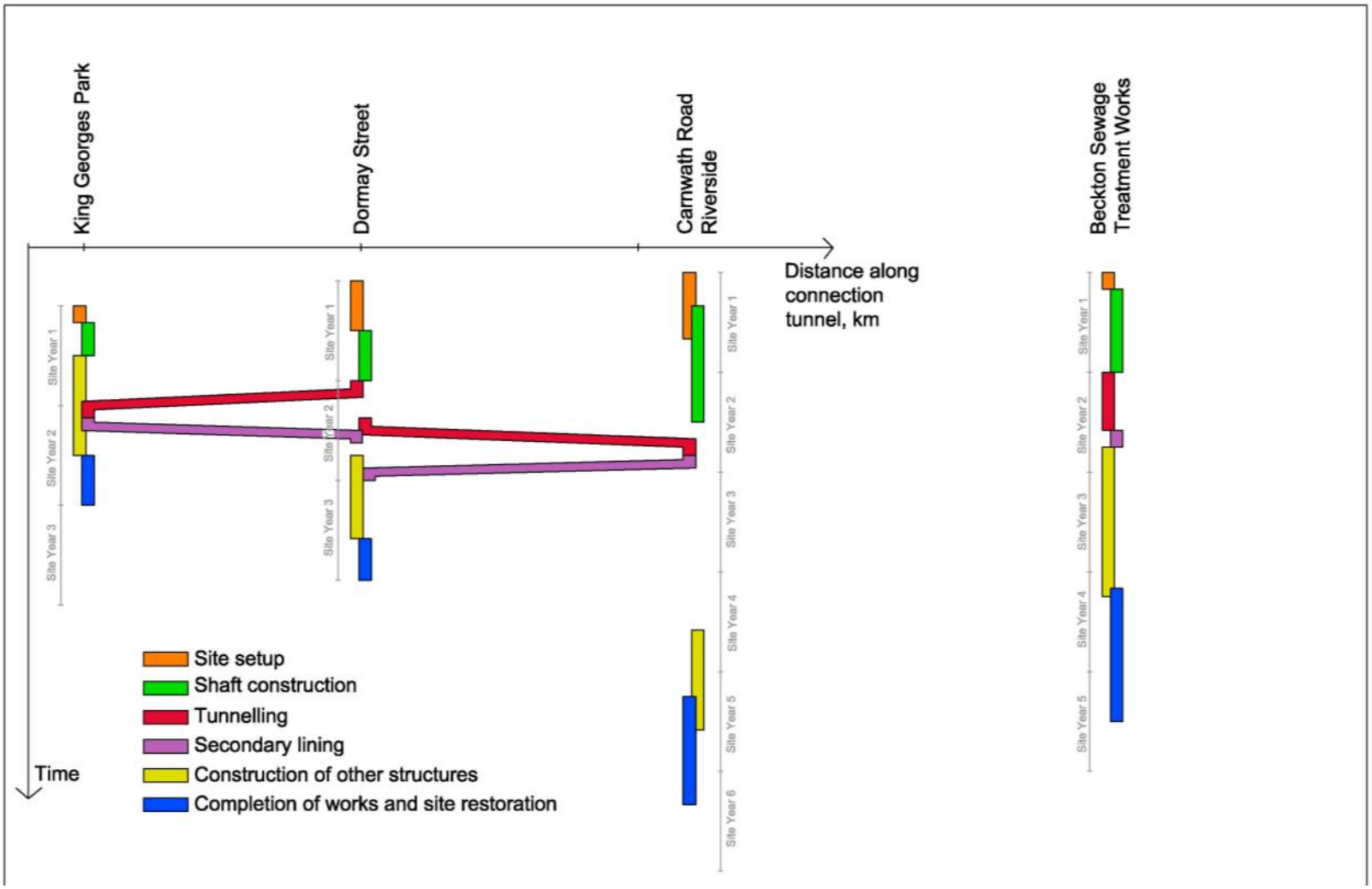
Vol 1 Plate 2.2.5 Assumed summary programme for the main tunnel including drive and reception shafts



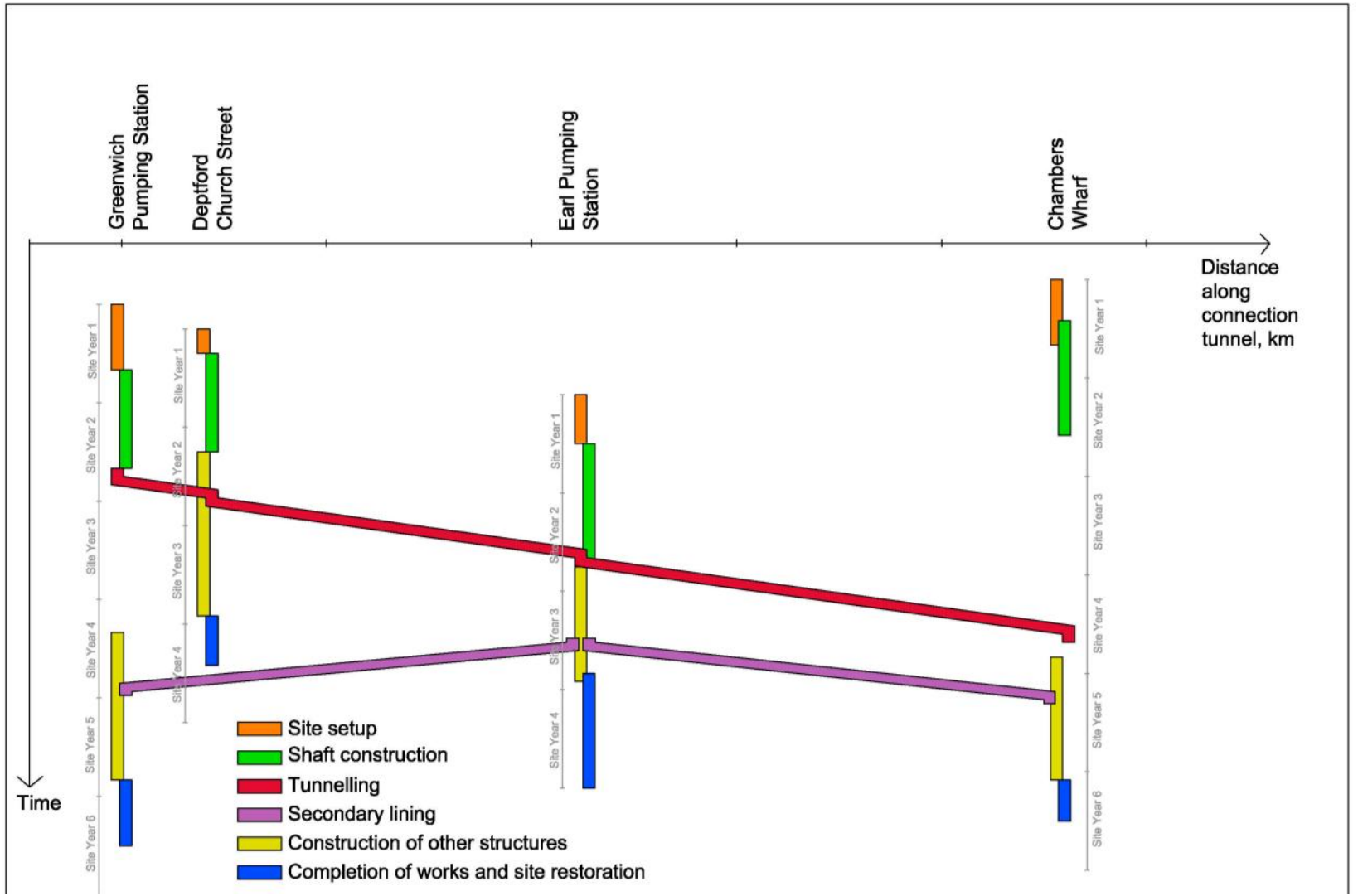
Vol 1 Plate 2.2.6 Assumed summary programme for the CSO drop shafts along the main tunnel



Vol 1 Plate 2.2.7 Assumed summary programme for the Frogmore connection tunnel and Beckton Sewage Treatment Works



Vol 1 Plate 2.2.8 Assumed summary programme for the Greenwich connection tunnel



2.2.41 Vol 1 Plate 2.2.5 to Vol 1 Plate 2.2.8 is an assumed and simplified programme. In practice construction of a complex project such as this would require thousands of individual activities to be considered and programmed. Furthermore the lines representing tunnelling progress are drawn assuming that the work progresses at average advance rates but in practice the day to day week to week rates would vary depending upon a number of factors. For example it is not unusual for work to start slowly as the construction teams become familiar with the plant and methods adopted (the 'learning curve') but the assumed programme shown in Vol 1 Plate 2.2.5 to Vol 1 Plate 2.2.8 does not show these variations.

2.2.42 Advance works including procurement, detailed design, planning and utility work would, where appropriate, be carried out before the main six year period.

2.2.43 For the assessment of impacts it has been assumed that construction at each site is considered over a number of 'site years'. If for example work at a particular site starts in May, then the first site year would be taken to be from May in the first year to April the following year. Project site years for each site are shown in Vol 1 Plate 2.2.5 to Vol 1 Plate 2.2.8.

Tunnel operation

Introduction

2.2.44 This section provides a summary of the proposed operation of the Thames Tideway Tunnel project. Further details regarding operational assumptions, across the project, and at the construction sites, are provided in Vol 3 Section 3.4, and Vols 4 to 27 Section 3.4, respectively.

2.2.45 The Thames Tideway Tunnel would operate in conjunction with the Lee Tunnel, the Beckton Sewage Treatment Works and Crossness Sewage Treatment Works. When the Thames Tideway Tunnel is completed there would be a single operational strategy that coordinates the operation of the two treatment works, major pumping stations and the London Tideway Tunnels (Lee and Thames Tideway Tunnels) (see Vol 3 Appendix L – CSO control and performance of the Thames Tideway Tunnel). This section includes an overview of:

a. commissioning

b. combined sewer discharges

c. ventilation

d. maintenance.

Commissioning

2.2.46 Full commissioning testing would be dependent on weather conditions and the status of the existing sewer infrastructure. No site would operate without all others being complete, and a commissioning plan has been agreed with the Environment Agency.

2.2.47 Prior to operation, all the components of the system including ventilation, dampers, penstock, flap valves, and instruments would be factory tested before installation into the system. They would be further tested after

installation to ensure that the system works as required prior to diversion of flow and making the system live.

2.2.48 The tunnel would be fully commissioned after the flow is allowed into the tunnel system. The interception structures would be designed to capture and divert to the tunnel combined storm flows when the capacity of the sewerage network is overwhelmed by a rain storm. CSO capture would stop when the tunnel system reaches pre-set water levels which would trigger closure of penstocks resulting in redirection of any remaining flow to the river.

2.2.49 The operation of the commissioned system would be described in an operating techniques agreement to be reached between the EA and Thames Water, and through permits to discharge at each CSO.

2.2.50 When commissioned the system of tunnels, pumping stations and the Beckton and Crossness Sewage Treatment Works would be operated as an integrated system.

Combined sewer discharges

Tunnel filling

2.2.51 The tunnel system would receive variable inflow from the controlled CSOs depending on rainfall over the catchment. The spatial variation of rainfall over the catchment would allow the tunnel system to capture heavy runoff in the east, and store in the western part of the tunnel, and heavy runoff in the west, and store in the eastern part of the system (ie, the whole tunnel system is used for storage whether the flow originates in the west or the east). The tunnel would fill from the bottom end (Beckton Sewage Treatment Works).

2.2.52 The CSO control system would be arranged so that the closure of penstocks at most CSO locations along the project close before the tunnel is completely full to allow continued inflow from Abbey Mills Pumping Station. This reservation of tunnel storage is to ensure infrequent spills from Abbey Mills Pumping Station to the Channelsea River and for protection of the River Lee. This strategy has been agreed with the EA, and has informed the project-wide surface water assessment (see Vol 3 Section 14, and also Vol 3 Appendix L).

Tunnel full - CSO discharges

2.2.53 When large catchment wide rainfall occurs the system storage would be fully utilised. With the typical year rainfall the system is estimated to discharge four times and result in a residual total annual discharge of approximately 2.4million m^3. This represents a capture of at least 94% of the existing typical year overflow volume estimate of 39million m^3.

2.2.54 Operation of penstocks controlling flow to the tunnel would start when water levels in the tunnel reach to about the invert of the main tunnel at the upper or western end at Acton Storm Tanks. When penstocks close any residual flow would be diverted to the river and would result in a CSO discharge.

Tunnel emptying - wastewater treatment

2.2.55 The tunnel system would be effective in capturing CSO discharges and this captured flow would be transferred to Beckton Sewage Treatment Works for treatment when capacity is available there for pump-out. The maximum pump-out capacity is 12.2m^3/s. .

2.2.56 It is likely that longer duration events would see periods of filling and emptying as the flow to Beckton Sewage Treatment Works changes and would allow pump-out of some of the stored combined sewage.

2.2.57 The time to empty the tunnel is variable depending on the volume of combined sewage captured and the flow arriving at Beckton Sewage Treatment Works. The storage duration of combined sewage would generally be less than 20 hours. Given the total storage capacity of the tunnel system (approximately 1.5 million m^3) it would take about 36 hours to empty a full tunnel system at full pump-out capacity. The maximum duration of storage of combined sewage in the typical year is about 48 hours resulting from a long duration rainfall event but with some intermittent pump-out during a storm. This maximum time is shorter than the estimated time for septic conditions to occur (estimated at 60 to 72 hours).

Air management

2.2.58 An *Air Management Plan* accompanies the application. The associated characteristics of the air management system have been used to inform the air quality and odour assessments in Vol 3 Section 4, and Vols 4 to 27 Section 4.

2.2.59 Vol 1 Plate 2.2.9 shows the proposed configuration of the air management arrangements. The purpose of the air management would be to control how air moves through the tunnel system and to manage and treat the air that exists in the system under expected operating conditions. It would also control where air enters the tunnel in order to provide a supply of fresh air into the tunnel so as to ensure the minimum one air change per day throughout the tunnel when it is empty.

2.2.60 The tunnel is estimated to be empty about 75% of the time in a typical year. During this time the tunnel would be mechanically ventilated by extraction fans at active air management plants to achieve a minimum of one air change every 24 hours. This is required to maintain a supply of fresh air in the tunnel, to ensure any malodorous air emanating from the tunnel is treated, to limit the build-up of slime on the tunnel lining and reduce the potential for corrosion. In order to achieve this minimum one air change, some sections of the tunnel would have a higher exchange rate per day due to the unequal distances between air inflow and air extraction shafts.

2.2.61 When the tunnel is utilised capturing, storing or pumping-out CSO wastewater, (about 25% of the time in a typical year), the operating regime of the air management system would change. Initially the air management system would continue to ventilate the entire system until shafts are “drowned out” as the tunnel fills. Air within a drowned out shaft would then be displaced through passive carbon filters as the shaft fills up. This passive filtration would remove any potential odour. At drowned drop

shafts where there is mechanical ventilation air would be circulated within the shaft and driven-out through the air treatment units by the fans operating at a reduced rate.

2.2.62 Under extreme tunnel filling events the high rate of wastewater flow into the tunnel would cause a high displacement of air throughout the tunnel. This large volume of displaced air would be released through ventilation structures but only for a short duration. The dampers controlling this short duration air release would only open when there is a build-up of pressure due to the rapid displacement of air and would not open in the normal operating condition.

2.2.63 At active plants when rapid tunnel filling causes the air displaced at the shafts to exceed the capacity of the fans and air treatment units a portion of the air would bypass the fans and treatment. These untreated releases would be via the high level ventilation columns where the air released is dispersed and diluted.

2.2.64 The Thames Tideway Tunnel system would have three active mechanical ventilation plants:

a. $20m^3/s$ extraction and air treatment plant at Acton Storm Tanks shaft

b. $20m^3/s$ extraction and air treatment plant at Carnwath Road Riverside shaft

c. $4m^3/s$ extraction and air treatment plant at Greenwich Pumping Station drop shaft.

2.2.65 In addition, the project would utilise the ventilation and air treatment plant proposed for the Lee Tunnel as follows:

a. $30m^3/s$ extraction and air treatment plant at Abbey Mills Pumping Station

b. $10m^3/s$ extraction and air treatment plant at the connection shaft at Beckton Sewage Treatment Works

c. $10m^3/s$ extraction and air treatment plant at the overflow shaft at Beckton Sewage Treatment Works.

2.2.66 The treatment capacity diminishes as the tunnel fills, but the full treatment capacity is not then needed since the air displaced is reduced; ie, as the tunnel fills with wastewater there is less air to expel therefore less air to treat. The passive filters come into play when the above shafts fill up and these provide a further total 20m3/s of treatment capacity.

2.2.67 All other main tunnel shafts and CSO drop shafts would have passive facilities for ventilation and dispersion with below ground passive air treatment units, which control the release of air by the pressure loss across them. All shafts would also have the capability to allow air intake.

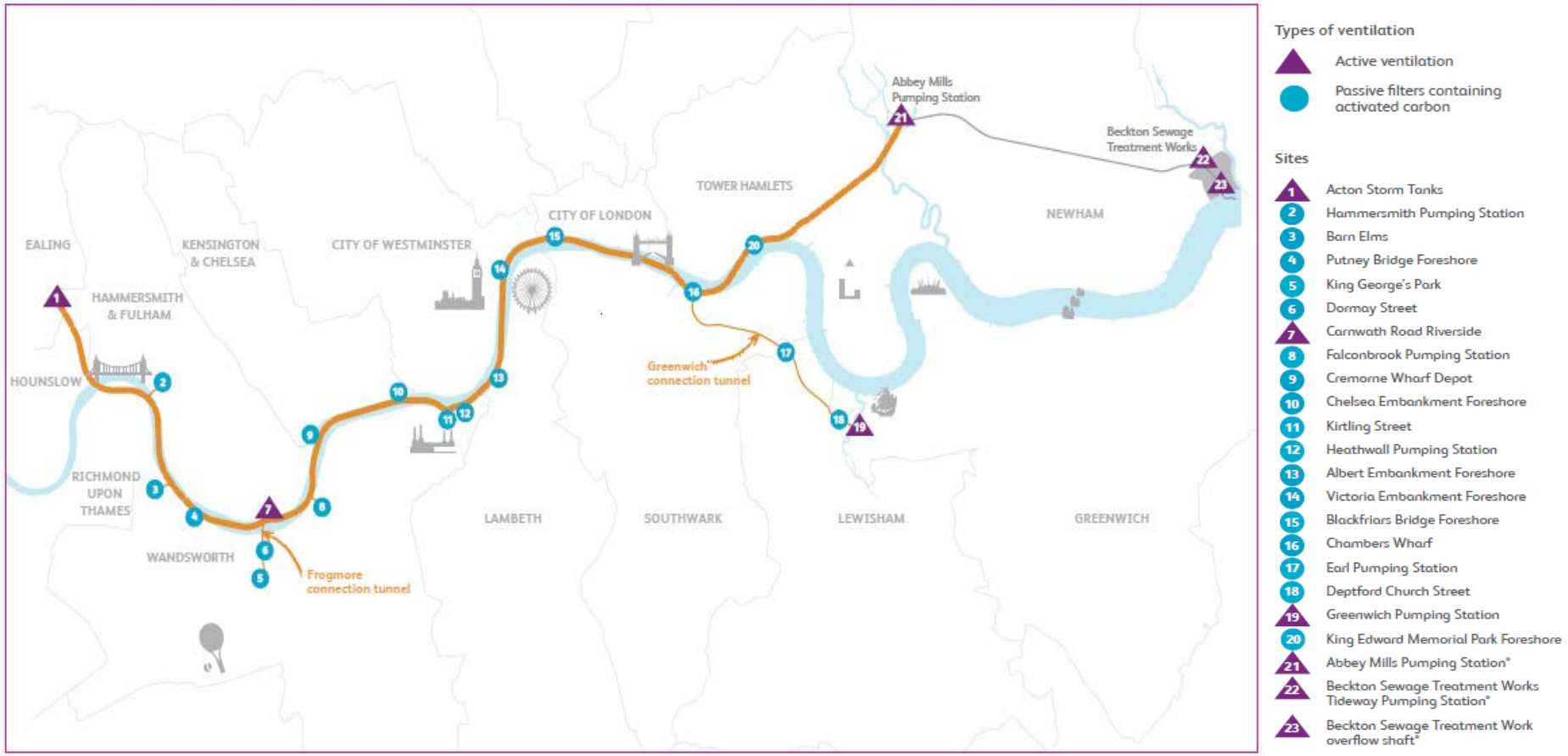
2.2.68 The air intake allows air to enter the tunnel when the stored wastewater is pumped out. Also when there are fluctuations in the wastewater level during filling the air intake would allow the tunnel to “breathe”.

2.2.69 The air intakes would also have weighted dampers allowing the reverse flow of air through the filter with selected air inlet structures having

dampers with a lower weight settling so they become the preferential air inflow points.

2.2.70 During a typical year, an average of 99.7% of the air released at each mechanical ventilation plant site would be treated. If the capacity of the ventilation plant is exceeded, then the portion of the air in excess of the treatment capacity would be untreated and released at high level for an average about 24 hours per year at each site as discrete events. This would occur for short periods of time (up to approximately two hours duration) and about 15 to 20 times per year when tunnel filling causes the air displaced from these shafts to exceed the capacity of the treatment. At passive filter sites 100% of the released air would be treated during the typical year, though under extreme storm events air could briefly discharge through pressure relief vents if the capacity of the filters is exceeded. Due to the pressure required to pass air through the carbon filters, the passive filter systems would only emit air on average for a total of 20 hours over five to ten discrete events during the typical year, depending upon location.

Vol 1 Plate 2.2.9 Location of active ventilation sites and passive filters sites

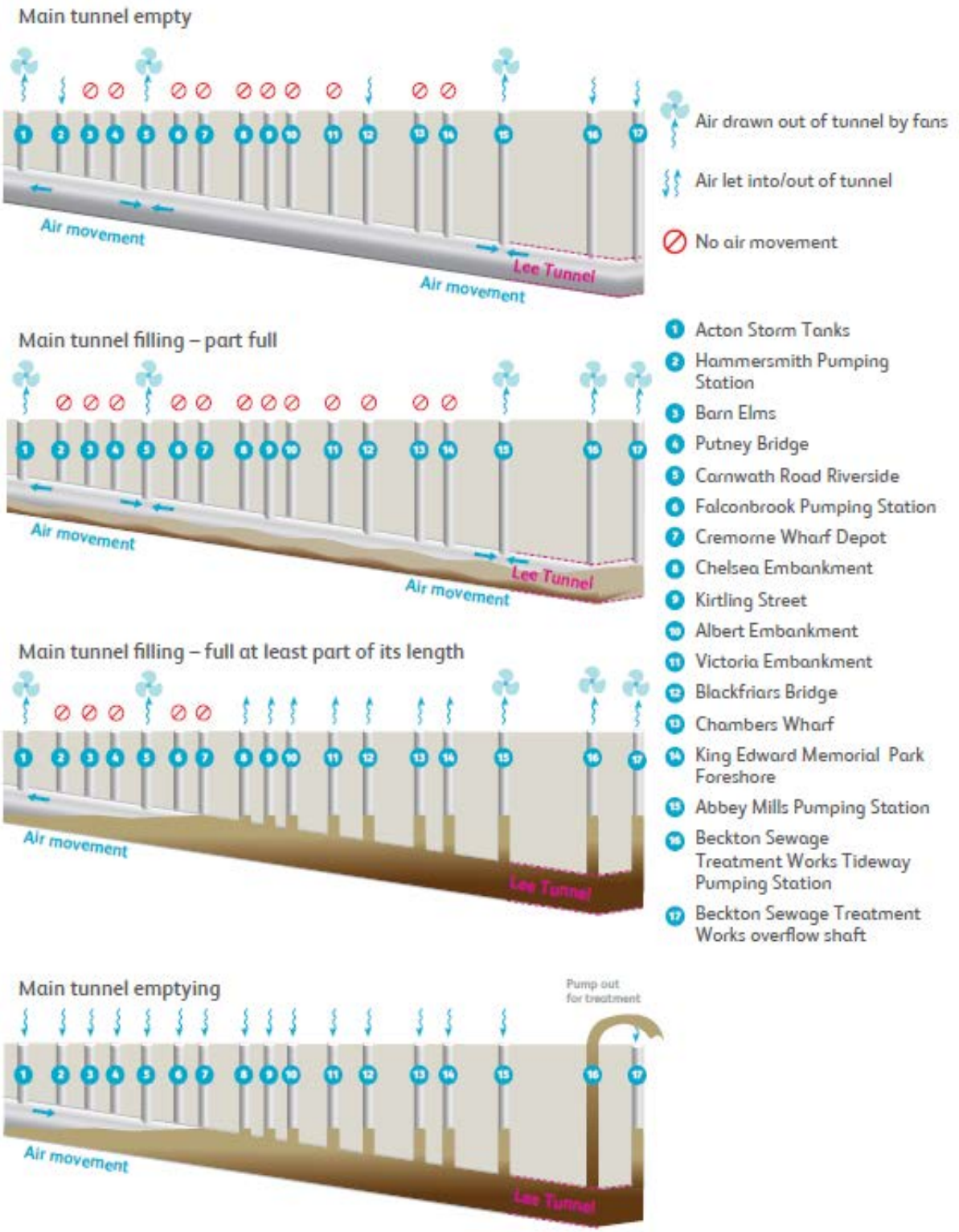


**Use will be made of the ventilation equipment installed as part of the Lee Tunnel project. There is no new ventilation building.*

2.2.71 The active mechanical ventilation and air treatment facilities would be housed outside at the Acton Storm Tanks site. The fans would be inside a building at the Carnwath Road Riverside site, with the air treatment units underground outside the building. The mechanical plant would be similar to facilitate operation and maintenance with a capacity at each plant of $20m^3/s$. A smaller facility with a capacity of $4m^3/s$ would be at Greenwich Pumping Station site, with similar equipment.

2.2.72 A schematic of how the air management system works is presented in Vol 1 Plate 2.2.10.

Vol 1 Plate 2.2.10 Schematic of how the air management system works



2.2.73 Passive facilities would mostly be contained within below ground chambers or vaults with above ground structures for air release and intake. Air release structures would have a minimum height of 4m in order to comply with the Thames Water hazardous zoning specifications[27].

2.2.74 At shafts with passive air treatment, air intake would be regulated by weighted dampers or by reverse flow through the filter. At each shaft air release would be controlled by the carbon filter. No air would be released until wastewater filling the tunnel seals the shaft and the wastewater rising in the shaft results in an increase of air pressure. When sufficient air pressure has developed air would pass through the carbon filters where potentially malodorous air would be treated prior to release via the air release structure.

2.2.75 At most interception chambers a ventilation column would be provided in accordance with the Thames Water standard specification for sewer ventilation[28]. In general this would draw air into the chamber during a CSO capture event.

2.2.76 Full details on the approach to air management are provided within the *Air Management Plan* which accompanies the application.

Maintenance and operation regime

Introduction

2.2.77 There would be no requirements for personnel to actively enter the interception and storage aspects of the system, but infrequent access for maintenance and inspection would be necessary. It is anticipated that this would include:

a. tunnel and shaft inspections and subsequent maintenance once every ten years

b. access to surface equipment housed in kiosks, ventilation and air treatment facilities or surface/shallow subsurface structures for routine inspection and maintenance of flap valves and penstocks and instrumentation every three to six months. Shallow facilities would be accessed via fixed access ladders, including top of drop shafts down to vortex access platform and CSO interception chambers

c. equipment inspections (eg, hydraulic lifting plant, penstocks, air flow and air treatment) every three to six months

d. operational access on an as required basis to deal with any blockages or other repairs/maintenance required

e. emergency access to the main tunnels and shafts.

2.2.78 During the maintenance period, penstocks to the tunnel would be closed off with the result that overflows could occur if rainfall events occur at the same time.

Air management system maintenance

2.2.79 Although the ventilation and air treatment plant would mostly be automated, routine three to six monthly inspection of mechanical and electrical equipment would be required.

2.2.80 At both the active and passive air management sites the maintenance requirements are limited to a periodic replacement of the filter media. It is estimated that this would have to be undertaken once every three years during dry weather periods.

2.2.81 At designated sites with active mechanical ventilation, the fans would operate continuously. Repair of one of the fans and/or motors at either site would therefore require a change in the operation of fans at the other site in order to maintain the required sweetening air flow throughout the tunnel system. The odour and ventilation plant is to be similar at each site. In this way, the need to store large quantities of spare parts is alleviated and standby equipment can be interchanged between the sites.

2.2.82 In addition to the inspection and maintenance of the ventilation plant, the seals on the various bolted covered openings in the roof of shafts, approach culverts and interception chambers, dampers and flap valves would be checked during routine maintenance inspections to ensure that there is limited air leakage. Excessive leakage could cause short circuiting of air flow and odour releases.

Scope of ten year inspection

2.2.83 Experience with other large diameter CSO tunnel systems suggests that inspection of the tunnels would only be needed infrequently. For this project the assumption is that inspections would occur on a ten-year cycle, accepting that system monitoring may show conditions necessary to perform inspections outside of this cycle. The scope of infrastructure to be inspected would comprise:

a. the main tunnel

b. all main tunnel shafts and CSO drop shafts

c. the two long connection tunnels: Greenwich connection tunnel and Frogmore connection tunnel

d. all short connection tunnels

e. junctions between the main tunnel, on line shafts, connection tunnels

f. connection culverts

g. CSO interception structures.

2.2.84 The connection culverts and CSO interception structures may have been inspected during routine maintenance but it is proposed that irrespective of any interim inspection the ten-yearly inspection of the entire system is undertaken to document the condition of the facilities and identify problems, repairs needed and potential maintenance issues.

2.2.85 It is anticipated that access to the bottom of all shafts and deep tunnels would be by contracted teams working under rigidly controlled conditions with specialist equipment to ensure safety.

2.2.86 The inspection contractor would provide the necessary transportable forced air equipment for each section of tunnel being inspected, but can also use the installed active mechanical ventilation plant.

2.2.87 The inspection would entail two mobile cranes. The larger diameter tunnels' inspection would be carried-out using bespoke inspection vehicles. Where possible remotely operated vehicles with CCTV cameras would be used for inspection.

2.2.88 It is anticipated that these maintenance periods would be of approximately two to three weeks duration at each main tunnel site.

Scope of sub-surface routine inspection and maintenance

2.2.89 It is envisaged that the following facilities would have their general operational maintenance undertaken by those responsible for the normal operation of the local sewer network and pumping stations:

a. connection culverts
b. CSO interception structures
c. penstocks and flap valves
d. instrumentation and control equipment
e. top of vortex drops
f. underground pressure relief/control dampers
g. the tunnel system pumping station at Beckton Sewage Treatment Works
h. other system pumping stations.

2.2.90 Some of the above facilities may require removal of obstructions or blockages at the vortexes or in the interception chambers. Penstocks, flap valve seals and proper operation would be essential to the safety and control of flows in the system.

2.2.91 Access to the CSO interception structures would be through standard square access covers using fixed ladders in accordance with Thames Water safety standards.

2.2.92 Access to the CSO vortex drops would be from concrete landings around the top of the drop pipes. Access openings that would allow man-riders to be lowered onto the landings in the event that depths exceed 12m, and provide access for mechanical grabs to remove any debris.

Scope of surface equipment routine maintenance

2.2.93 Items to be inspected and maintained would include:

a. active permanent ventilation fans at Acton Storm Tanks, Carnwath Road Riverside, Greenwich Pumping Station, Abbey Mills Pumping Station and Beckton Sewage Treatment Works
b. passive air treatment systems at all sites
c. air dampers
d. kiosks housing instrumentation, power packs and equipment for the operation of penstocks and flap valves and the measurement of flows/water levels throughout the system
e. CCTV cameras

f. lighting where provided.

2.2.94 Access and parking for maintenance vehicles would be provided.

Residual overflows during operation

2.2.95 Penstocks would close when water levels in the tunnel are about to reach the soffit at Hammersmith Pumping Station. When they close any residual flow would be diverted into the tidal Thames through the existing or relocated CSO discharge. As the tunnel system in most instances would have captured the potential discharges at all but a few of the intercepted CSOs the residual flow would be minimal.

Operational resilience

2.2.96 The design requires facilities to be built above flood defence levels, or to be behind flood defences with sealed covers to limit water incursion. If a 'catastrophic' flood event occurs the system would revert to the current operation of the collection system and the tunnel system would be isolated. The CSO control facilities are not dependent on pumping so pumping failure is not critical.

Decommissioning

2.2.97 The design life of the infrastructure for the project is estimated to be 120 years. Decommissioning of the project infrastructure is not anticipated.

2.2.98 Mechanical, electrical and other components would require replacement or renewal as part of a planned maintenance regime and allowance has been made to facilitate access. No decommissioning or demolition is anticipated in connection with the planned maintenance regime.

Other potential operational issues – dust, smoke, steam, insect infestation and vermin

2.2.99 The NPS identifies a number of issues which have the potential to cause a detrimental impact on amenity or cause nuisance under relevant environmental legislation. Dust, smoke, steam and insect infestation are all identified as possible issues in NPS para. 4.12.1.

2.2.100 The potential for dust, smoke, steam and insect/vermin infestation during operation of the tunnel to be experienced at the surface is unlikely due to the nature and design of the tunnel together with the proposed tunnel operational procedures and maintenance regime which have been described in this section.

2.3 Proposed development summary – the construction sites

2.3.1 The following section provides summary information on the construction sites associated with the project, running from west to east. Detailed descriptions of the proposed development which has been assessed at each of the proposed sites are provided in the site effects assessment volumes (Vols 4 to 27, Section 3).

Acton Storm Tanks

2.3.2 A work site is required to receive the main tunnel from Carnwath Road Riverside and to connect the existing Acton Storm Relief CSO to the main tunnel. The proposed development site is known as Acton Storm Tanks, which is located in the London Borough of Ealing. It lies adjacent to the London Borough of Hammersmith and Fulham to the east, and is close to the London Borough of Hounslow to the south.

2.3.3 Acton Storm Tanks is a Thames Water operational site that comprises six open storm water tanks, associated infrastructure, the existing pumping station, grassed areas and two areas of hardstanding used for parking. The limits of land to be acquired or used (LLAU) also include Canham Road and its junctions with Stanley Gardens and Warple Way.

2.3.4 The site is bounded by Canham Road to the north; Warple Way to the east and southeast; and a private car park to the southwest and west (see Vol 1 Plate 2.3.1).

Vol 1 Plate 2.3.1 Acton Storm Tanks – aerial photograph

2.3.5 Summary features of the proposed development site at Acton Storm Tanks are presented in Vol 1 Table 2.3.1.

Vol 1 Table 2.3.1 Summary features of proposed development at Acton Storm Tanks

Feature	Information
Existing uses	A brownfield site consisting of an operational Thames Water pumping station and storm tanks facility
Proposed uses	Main tunnel single reception from Carnwath Road Riverside, and CSO interception site
Approximate maximum site working area*	2.3 hectares
Approximate shaft depth (to invert level)	31m
Approximate shaft internal diameter	15m
Approximate construction start year and duration	2018; three and a half years
Construction activities and durations	Site Year 1 – Site preparation (approximately five months) Site Year 1 to 2 – Shaft construction (approximately eight months) Site Year 2 to 3 – Secondary lining (approximately seven months) Site Years 3 to 4 – Construction of other structures (approximately 12 months) Site Years 3 to 4 – Completion of works and site restoration (approximately 12 months)
Working hours**	Standard and also continuous working hours. Continuous hours would be required during secondary lining, mainly below ground, for a duration of approximately seven months
Construction transport mode	All by road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	23/day; during shaft construction and secondary lining***
Approximate excavated material amount	3,250 tonnes

Feature	Information
Above-ground operational structures - maximum height (m)	Overflow chamber = 2.0m Interception chamber = 2.0m Ventilation column(s) serving the shaft = 15.0m Inlet ventilation structure(s) = 2.0m Outlet ventilation structure(s) = 2.5m Ventilation structures for fans = 3.5m

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Hammersmith Pumping Station

2.3.6 A work site is required to connect the Hammersmith Pumping Station CSO to the main tunnel. The proposed development site is known as Hammersmith Pumping Station, which is located in the London Borough of Hammersmith and Fulham.

2.3.7 The site itself comprises part of the Thames Water operational Hammersmith Pumping Station; an area of a vacant former industrial site formerly known as Hammersmith Embankment and now as 'Fulham Reach'; and two small highway worksites: one in Chancellor's Road (for construction of a rising main) and the other in Chancellor's Road/Distillery Road (for a kerb realignment). The Fulham Reach site primarily comprises hardstanding with a few small patches of vegetation.

2.3.8 The site is bounded by Chancellor's Road to the northwest, by Distillery Road to the northeast, and by the Fulham Reach site to the southeast and southwest (see Vol 1 Plate 2.3.2).

Vol 1 Plate 2.3.2 Hammersmith Pumping Station – aerial photograph

2.3.9 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.2.

Vol 1 Table 2.3.2 Summary features of proposed development at Hammersmith Pumping Station

Feature	Information
Existing uses	Hard surfaced areas, vegetation and an operational Thames Water pumping station
Proposed uses	CSO interception and connection tunnel drive site
Approximate maximum site working area*	0.6 hectares
Approximate shaft depth (to invert level)	33m
Approximate shaft internal diameter	11m
Approximate construction start year and duration	2017; three years
Construction activities and durations	Site Year 1 – Site preparation (approximately two months) Site Year 1 - Shaft construction (approximately four months) Site Years 1 to 2 - Tunneling (approximately nine months) Site Years 2 to 3 – Construction of other structures

Feature	Information
	(approximately 12 months) Site Year 3 – Completion of works and site restoration (approximately eight months).
Working hours**	Standard hours, and continuous working hours for tunneling (mainly underground) for a nine month period
Construction transport mode	By road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	21/day; during tunnelling***
Approximate excavated material amount	36,000 tonnes
Above-ground operational structures - maximum height	Ventilation structure(s) = 4.5m Ventilation column(s) serving the interception chamber = 9.0m (with minimum 8.5m) Ventilation column(s) and ventilation structure(s) serving the inlet of the pumping station = 9.0m (with minimum 4.0m) Replacement screen house = 9.5m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Barn Elms

2.3.10 A work site is required to connect the West Putney Storm Relief CSO to the main tunnel. The proposed development site is known as Barn Elms, which is located in the London Borough of Richmond upon Thames near the London Borough of Wandsworth.

2.3.11 The site itself comprises a band of greenfield land along the northern, eastern and southern borders of the Barn Elms Schools Sports Centre (BESSC), and a small area of roadway at the junction of Queen Elizabeth Walk and Rocks Lane. The playing fields area of the BESSC is owned and operated by the London Borough of Wandsworth. The BESSC is a separate facility to the adjacent Barn Elms Playing Fields to the west, which is owned and operated by the London Borough of Richmond upon Thames.

2.3.12 The site is bounded to the north by the pedestrian section of Queen Elizabeth Walk, to the east by a line of mature trees and the Thames Path, to the southeast and south by Beverley Brook (approximately 15m from the site), and to the west by the BESSC (see Vol 1 Plate 2.3.3).

Vol 1 Plate 2.3.3 Barn Elms – aerial photograph

2.3.13 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.3.

Vol 1 Table 2.3.3 Summary features of proposed development at Barn Elms

Feature	Information
Existing uses	Closely-mown amenity grassland for use as sport pitches within the Barn Elms School Sports Centre, with strips of semi-mature trees along the south-western and eastern boundaries
Proposed uses	CSO interception and connection tunnel drive site
Approximate maximum site working area*	3.1 hectares
Approximate shaft depth to invert level	34m
Approximate shaft internal diameter	6m
Approximate construction start year and duration	2017; two and a half years
Construction activities and durations	Site Year 1 – Site preparation (approximately three month) Site Year 1 - Shaft construction (approximately three months) Site Year 1 to 2 - Tunnelling (approximately five

Feature	Information
	months) Site Years 2 to 3 – Construction of other structures (approximately eight months) Site Year 3 – Completion of works and site restoration (approximately nine months).
Working hours**	standard and also continuous working hours (continuous for five months during tunneling activities, mainly underground)
Construction transport mode	By road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	22/day; one month, during demolition of an existing sports changing room facility and during the construction of the temporary access route
Excavated material amount	13,000 tonnes
Permanent infrastructure above-ground	Shaft 1m above existing ground level Integrated electrical kiosk(s) and ventilation column(s) and habitat enclosure: 6m (with minimum 4m).

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

Putney Embankment Foreshore

2.3.14 A work site is required to connect the Putney Bridge CSO to the main tunnel. The proposed development site is known as Putney Embankment Foreshore, which is located in the London Borough of Wandsworth.

2.3.15 The site itself comprises an area of the foreshore of the River Thames and is divided into two sections. The main site is known as the 'Putney Embankment CSO' site, which lies between St Mary's Church up to and including the historic (not listed) Putney Pier, at which two residential houseboats are moored. The secondary site is known as the 'Putney Embankment Temporary Slipway' site, which lies between Thames Place and Glendarvon Street.

2.3.16 The site is bounded by the River Thames to the north, east and west. An area of open space known as Waterman's Green, Lower Richmond Road and the Embankment carriageway form the southern boundary of the Putney Embankment CSO site. The Embankment carriageway also forms the southern boundary of the Putney Embankment Temporary Slipway site (see Vol 1 Plate 2.3.4).

Vol 1 Plate 2.3.4 Putney Embankment Foreshore – aerial photograph

2.3.17 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.4.

Vol 1 Table 2.3.4 Summary features of proposed development at Putney Embankment Foreshore

Feature	Information
Existing uses	The tidal Thames foreshore
Proposed uses	CSO interception and connection tunnel drive site
	Temporary slipway
Approximate maximum site working area*	2.8 hectares
Approximate shaft depth to invert level	36m
Approximate shaft internal diameter	6m
Approximate start year and construction duration	2016; three and a half years
Construction activities and durations	Site Years 1 to 2 – Site set up (approximately 12 months) Site Years 1 to 2 - Shaft construction (approximately six months) Site Year 2 - Tunnelling (approximately two months) Site Years 2 to 3 – Construction of other structures (approximately 16 months)

Feature	Information
	Site Year 3 – Completion of works and site restoration (approximately ten months).
Working hours**	Standard, and continuous (continuous during construction of short connection tunnels, mainly below ground, for a duration of approximately two months).
Construction transport mode	90% by river
Peak monthly average barge numbers, and when	2/day; one month, during removal of temporary cofferdam fill
Peak monthly average lorry numbers, and when	21/day; one month, during sewer connection works and fit out
Approximate excavated material amount	32,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the shaft - 8m (with minimum 4.0m) Ventilation column(s) serving the interception chamber - 6.0m Electrical and control kiosk(s) assigned to the foreshore structure - 4.0m from existing pavement and 2.5m from new foreshore structure Electrical and control kiosk assigned to Waterman's Green – 3m Interception chamber – the maximum height of interception chamber would not be above springing point of the bridge arch.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

Dormay Street

2.3.18 A work site is required to connect the Frogmore Storm Relief – Bell Lane Creek CSO to the Frogmore connection tunnel, which would transfer wastewater flows into the main tunnel. The proposed development site is known as Dormay Street, which is located in the London Borough of Wandsworth.

2.3.19 The site itself comprises part of the Frogmore Industrial Complex and Causeway Island. It is mostly made up of hardstanding.

2.3.20 The site is bounded by railway lines and a vehicle storage area to the north, by The Causeway to the east, beyond which lies the River Wandle and to the south by the junction of Dormay Street and Armoury Way (see Vol 1 Plate 2.3.5). A London Borough of Wandsworth maintenance depot is situated to the west. The Frogmore Storm Relief – Bell Lane Creek CSO runs through the western section of the site and discharges into Bell Lane Creek, which runs through the centre of the site.

Vol 1 Plate 2.3.5 Dormay Street – aerial photograph

2.3.21 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.5.

Vol 1 Table 2.3.5 Summary features of proposed development at Dormay Street

Feature	Information
Existing uses	The site forms part of the Wandsworth Depot, an industrial estate comprising various industrial units with associated loading/unloading areas and car parking. The site is located on both sides of Bell Lane Creek
Proposed uses	CSO interception and connection tunnel drive to King George's Park and Carnwath Road Riverside
Approximate maximum site working area*	1.0 hectare
Approximate shaft depth to invert level	24m
Approximate shaft internal diameter	12m
Approximate construction start year, and duration	2016; three years
Construction activities and durations	Site Year 1 – site preparation (approximately six months)

Feature	Information
	Site Year 1 – CSO drop shaft construction (approximately six months) Site Years 1 to 2 - tunnelling (approximately nine months) Site Years 2 to 3 – construction of other structures (approximately ten months) Site Years 3 to 4 – completion of works and site restoration (approximately five months)
Working hours**	Standard and also continuous (for approximately four and a half months during the long connection tunnel drive, and for approximately two months during secondary lining)
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	25/day; during tunnelling***
Approximate excavated material amount	32,500 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the interception chamber: 6m Integrated electrical and control kiosk(s) and ventilation structure(s): 6m integrated kiosk (with minimum high 3m electrical and control kiosk and 4m ventilation structure).

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

King George's Park

2.3.22 A work site is required to intercept the Frogmore Storm Relief – Buckhold Road CSO and to receive the Frogmore connection tunnel, which would be driven from Dormay Street. The proposed development site is known as King George's Park, which is located in the London Borough of Wandsworth.

2.3.23 The site itself comprises land at the northern end of King George's Park, adjacent to the main Buckhold Road entrance. The land comprises open grassland, public footpaths and scattered mature trees. The site and the surrounding area are relatively flat and low lying, and are situated within the floodplain of the River Wandle.

2.3.24 The site is bounded to the north by the Buckhold Road/Neville Gill Close junction. To the east it is bordered by Neville Gill Close, to the south by the ornamental lake and a dense area of mature trees within the park to the

southwest. It is bounded to the west by Buckhold Road (see Vol 1 Plate 2.3.6).

Vol 1 Plate 2.3.6 King George's Park – aerial photograph

2.3.25 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.6.

Vol 1 Table 2.3.6 Summary features of proposed development at King George's Park

Feature	Information
Existing uses	Occupies the northern tip of King George's Park, adjacent to the entrance from Buckhold Road (A218) at the junction with Neville Gill Close
Proposed uses	CSO interception and connection tunnel reception site
Approximate maximum site working area*	0.4 hectares
Approximate shaft depth to invert level	21m
Approximate shaft internal diameter	9m
Approximate construction start year, and duration	2017; two and a half years
Construction activities and	Site Year 1 – Site preparation (approximately two

Feature	Information
durations	months) Site Year 1 - Shaft construction (approximately four months) Site Years 1 to 2 – Construction of other structures (approximately 12 months) Site Years 2 to 3 – Completion of works and site restoration (approximately 6 months).
Working hours**	Standard
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	8/day; during shaft construction***
Approximate excavated material amount	5,200 tonnes
Permanent infrastructure above-ground	Integrated ventilation and electrical and control kiosk(s) – 3.0m Ventilation columns serving the shaft – 8.0m (with minimum 4.0m) Ventilation columns serving the interception chamber – 6.0m

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Carnwath Road Riverside

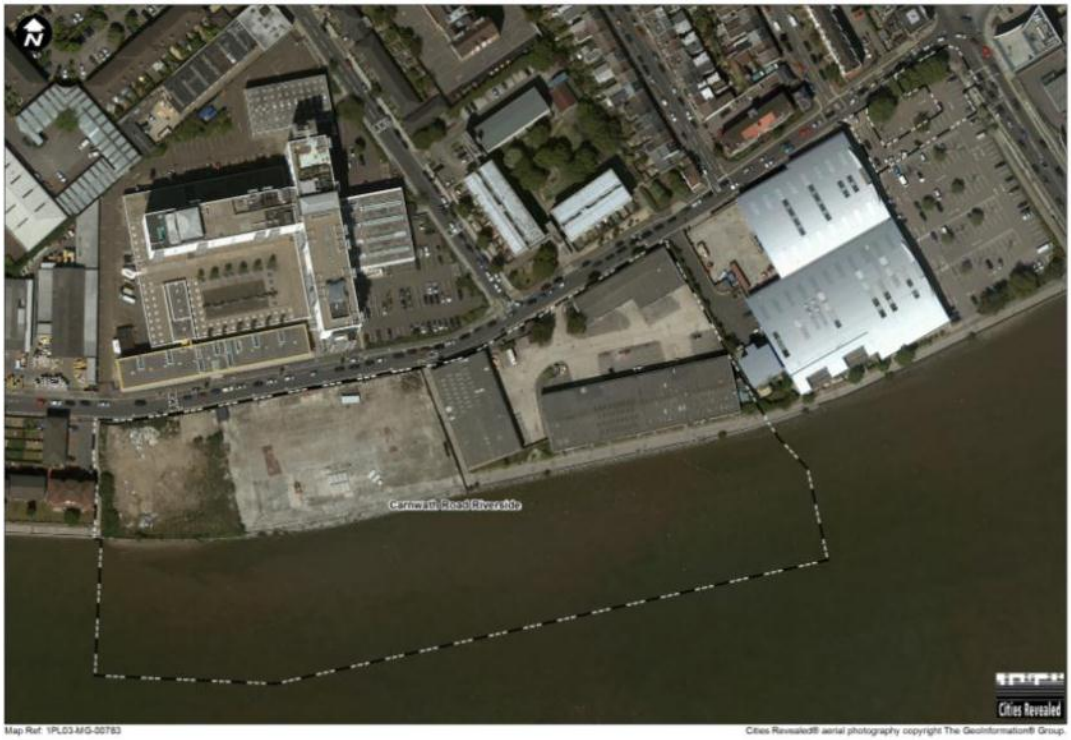
2.3.26 A work site is required to drive the main tunnel west to Acton Storm Tanks, to receive the main tunnel drive from Kirtling Street and to receive the Frogmore connection tunnel drive from Dormay Street. The proposed development site is known as Carnwath Road Riverside, which is located in the in the South Fulham Riverside Regeneration Area of London Borough of Hammersmith and Fulham. The London Borough of Wandsworth lies on the opposite side of the river.

2.3.27 The site itself comprises three adjacent parcels of land: Whiffin Wharf and the safeguarded Hurlingham Wharf, which are both largely vacant areas of hardstanding with some existing unauthorised uses, and Carnwath Road Industrial Estate, which contains two-storey industrial, warehouse and retail units. The site also includes an area of the foreshore of the River Thames in front of all three parcels.

2.3.28 The site is bounded to the north by Carnwath Road, to the east by a four-storey residential block and a PC World superstore, to the south by the

River Thames, and to the west by three to four-storey residential dwellings that overlook the site and the River Thames (see Vol 1 Plate 2.3.7).

Vol 1 Plate 2.3.7 Carnwath Road Riverside – aerial photograph



2.3.29 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.7.

Vol 1 Table 2.3.7 Summary features of proposed development at Carnwath Road Riverside

Feature	Information
Existing uses	Adjacent to the tidal Thames, incorporating Hurlingham Wharf (a safeguarded wharf), which is currently vacant, as well as Whiffin Wharf to the west and the Carnwath Road Industrial Estate to the east, which contains a number of two storey industrial and warehouse units.
Proposed uses	Main tunnel single drive to Acton Storm Tanks and single reception from Kirtling Street, and connection tunnel reception site from Dormay Street
Approximate maximum site working area*	3.6 hectares
Approximate shaft depth to invert level	42m
Approximate shaft internal diameter	25m
Approximate construction start year, and duration	2016; six years

Feature	Information
Construction activities and durations	Site Year 1 - Site setup (approximately eight months) Site Year 1 to 2 - Shaft construction (approximately 14 months) Site Year 2 to 4 - Tunnelling (approximately 22 months) Site Year 4 - Secondary lining (approximately seven months) Site Year 4 to 5 - Construction of other structures (approximately 12 months) Site Year 5 to 6 - Completion of works and site restoration (approximately 13 months)
Working hours**	Standard, and continuous (for approximately 29 months during tunneling and secondary lining, so primarily underground)
Construction transport mode	90% by river
Peak monthly average barge numbers, and when	2/day; during tunneling
Peak monthly average lorry numbers, and when	45/day; during tunneling***
Approximate excavated material amount	785,500 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the main tunnel shaft - 15m Ventilation building - 5.5m

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for some of the period*

Falconbrook Pumping Station

2.3.30 A work site is required to connect the Falconbrook Pumping Station CSO to the main tunnel. The proposed development site is known as Falconbrook Pumping Station, which is located in the London Borough of Wandsworth.

2.3.31 The site itself comprises part of the Thames Water operational Falconbrook Pumping Station compound, a disused toilet block to the southwest of the pumping station and part of an area of public realm adjacent to the York Gardens Library and Community Centre.

2.3.32 The site is bounded to the north by York Gardens Children's Centre and Adventure Playground. York Gardens surrounds the site to the east and south, and it is bounded to the west by York Road (see Vol 1 Plate 2.3.8).

Vol 1 Plate 2.3.8 Falconbrook Pumping Station – aerial photograph

2.3.33 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.8.

Vol 1 Table 2.3.8 Summary features of proposed development at Falconbrook Pumping Station

Feature	Information
Existing uses	Predominantly within the grounds of an operational Thames Water pumping station. A proportion of the site is occupied by a disused toilet block
Proposed uses	CSO interception and connection tunnel drive site
Approximate maximum site working area*	0.5 hectares
Approximate shaft depth to invert level	40m
Approximate shaft internal diameter	9m
Approximate construction start year, and duration	2018; three years
Construction activities and durations	Site Year 1 – Site preparation (approximately three months) Site Year 1 - Shaft construction (approximately six months)

Feature	Information
	Site Years 1 to 2 - Tunnelling (approximately six months) Site Years 2 to 3 – Construction of other structures (approximately 12 months) Site Year 3– Completion of works and site restoration (approximately six months).
Working hours**	Standard, and continuous (during construction of Falconbrook connection tunnel for a duration of approximately six months, primarily below ground)
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	18/day; during tunneling***
Approximate excavated material amount	20,000 tonnes
Permanent infrastructure above-ground	Valve chamber: 2.0m Ventilation column(s) serving the drop shaft: 8m (with minimum of 4m) Ventilation column(s) serving the interception chamber: 6m Ventilation structure(s): 3m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Cremorne Wharf Depot

2.3.34 A work site is required to connect the Lots Road Pumping Station CSO to the main tunnel. The proposed development site is known as Cremorne Wharf Depot, which is located in the Royal Borough of Kensington and Chelsea.

2.3.35 The site itself comprises an existing council depot used for storage and street cleaning, the Thames Water Lots Road Pumping Station and the River Thames foreshore.

2.3.36 The site is bounded to the north by the Chelsea Wharf, to the east by the River Thames, to the south by Chelsea Creek, and to the west by Lots Road (see Vol 1 Plate 2.3.9).

Vol 1 Plate 2.3.9 Cremorne Wharf Depot – aerial photograph

2.3.37 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.9.

Vol 1 Table 2.3.9 Summary features of proposed development at Cremorne Wharf Depot

Feature	Information
Existing uses	The site is on an existing local authority depot which will be demolished during construction and reinstated following construction.
Proposed uses	CSO interception site and connection tunnel drive site
Approximate maximum site working area (hectares)*	0.6 hectares
Approximate shaft depth to invert level (m)	42m
Approximate shaft internal diameter (m)	8m
Approximate construction start year, and duration	2018; three years
Construction activities and durations	Site Year 1 – Site setup (approximately four months) Site Year 1 - Shaft construction (approximately eight months)

Feature	Information
	Site Year 2 – Tunnelling (approximately six months) Site Years 2 to 3 – Construction of other structures (approximately 12 months) Site Year 3 – Completion of works and site restoration (approximately five months)
Working hours**	Standard, and continuous for connection tunnel construction period of approximately six months, and primarily underground.
Construction transport mode	90% river
Peak monthly average barge numbers, and when	1/day; during tunnelling
Peak monthly average lorry numbers, and when	12/day; during tunnelling***
Approximate excavated material amount	20,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the shaft = 8m (with minimum 4.0m).

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Chelsea Embankment Foreshore

2.3.38 A work site is needed to intercept the existing Ranelagh CSO and connect to the northern Low Level Sewer No.1 to divert flows to the main tunnel. The proposed development site is known as Chelsea Embankment Foreshore, which is located in the Royal Borough of Kensington and Chelsea.

2.3.39 The site itself comprises the foreshore of the River Thames opposite the Bull Ring Gates of the Royal Hospital Chelsea South Grounds, sections of Chelsea Embankment carriageway and pavement, and a small section of Ranelagh Gardens.

2.3.40 The site is bounded to the north by the Royal Hospital Chelsea, the hospital's South Grounds, and Ranelagh Gardens. To the northeast lies the Lister Hospital and Chelsea Bridge Gardens on the north side of Chelsea Bridge Road and to the east Chelsea Bridge crosses the River Thames. The River Thames surrounds the site to the east, south and west (see Vol 1 Plate 2.3.10).

Vol 1 Plate 2.3.10 Chelsea Embankment Foreshore – aerial photograph

2.3.41 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.10.

Vol 1 Table 2.3.10 Summary features of proposed development at Chelsea Embankment Foreshore

Feature	Information
Existing uses	The tidal Thames foreshore, to the west of Chelsea Bridge
Proposed uses	CSO interception and connection tunnel drive site
Approximate maximum site working area*	2.5 hectares
Approximate shaft depth to invert level	45m
Approximate shaft internal diameter	12m
Approximate construction start year, and duration	2017; four years
Construction activities and durations	Site Year 1 – Site setup (approximately ten months) Site Years 1 to 2 - Shaft construction (approximately eight months) Site Year 2 - Tunnelling (approximately four month) Site Years 2 to 4 – Construction of other structures

Feature	Information
	(approximately 16 months) Site Year 4 – Completion of works and site restoration (approximately eight months).
Working hours**	Standard, and continuous for four months of short connection tunnel construction (when activities are generally underground).
Construction transport mode	90% by river
Peak monthly average barge numbers, and when	3/day; one month, during cofferdam construction
Peak monthly average lorry numbers, and when	42/day; one month, during sewer connection fit out
Approximate excavated material amount	99,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the shaft = 8m (with minimum 4.0m) Ventilation column(s) serving the interception chamber and overflow weir chambers = 6.0m Electrical and control kiosks = 1.5m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

Kirtling Street

2.3.42 A work site is required to drive the main tunnel in two directions concurrently, to Chambers Wharf in the east and Carnwath Road Riverside in the west. The proposed development site is known as Kirtling Street, which is located in the Nine Elms/Battersea area of the London Borough of Wandsworth.

2.3.43 The site itself comprises four separate adjacent pieces of land, as follows:

a. Kirtling Wharf (currently a concrete batching works), also known as Cringle Wharf

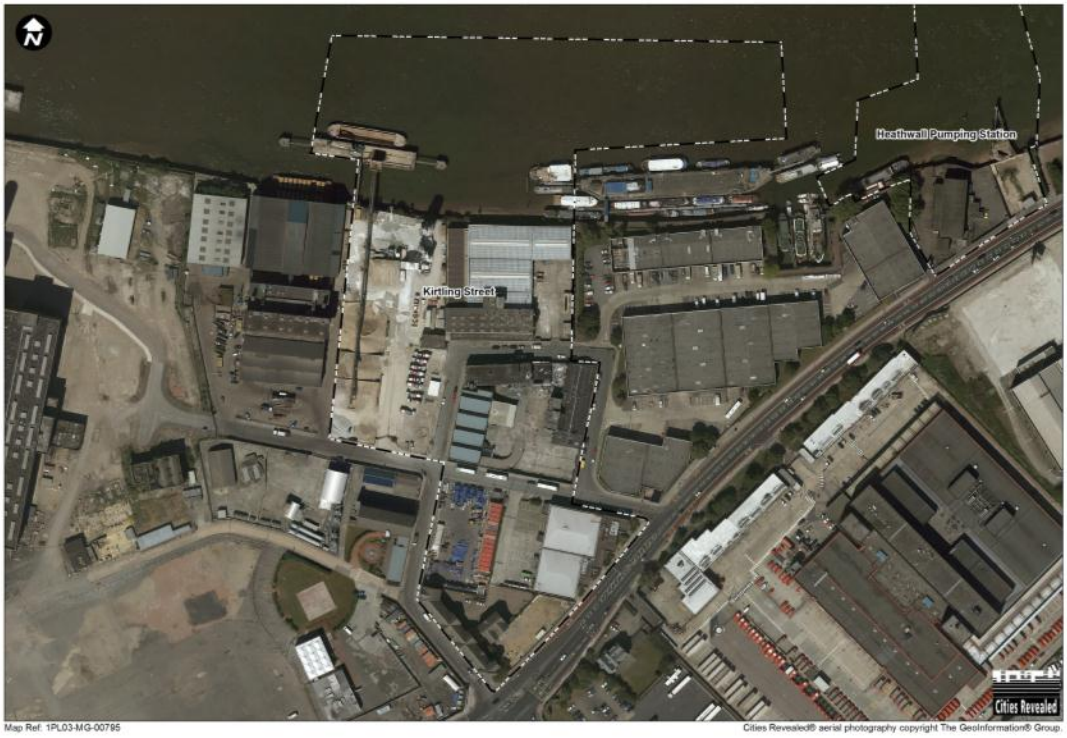
b. a depository used by the Victoria and Albert Museum

c. an unused depot

d. a mixed use area.

2.3.44 The site is bounded to the north by the River Thames, to the east by the Tideway Walk (Riverlight) development, to the south by Nine Elms Lane and Kirtling Street, and to the west by a waste transfer station and a Thames Water ring main pumping station (see Vol 1 Plate 2.3.11. It is bisected by Kirtling Street.

Vol 1 Plate 2.3.11 Kirtling Street – aerial photograph



2.3.45 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.11.

Vol 1 Table 2.3.11 Summary features of proposed development at Kirtling Street

Feature	Information
Existing uses	Adjacent to the tidal Thames, and situated across multiple parcels of land currently occupied by industrial warehousing, an aggregate batching plant, a depot, former petrol filling station and office buildings within the Nine Elms Industrial Area
Proposed uses	Main tunnel double drive to Carnwath Road Riverside and Chambers Wharf
Approximate maximum site working area*	5.2 hectares
Approximate shaft depth to invert level	48m
Approximate shaft internal diameter	30m
Approximate construction start year, and duration	2016; six years
Construction activities and	Site Years 1 – Site setup (approximately seven

Feature	Information
durations	months) Site Years 1 to 2 - Shaft construction (approximately 15 months) Site Years 2 to 4 - Tunnelling (approximately 26 months) Site Years 4 to 5 – Secondary lining (approximately 11 months) Site Years 5 to 6 – Construction of other structures (approximately eight months) Site Years 6 – Completion of works and site restoration (approximately five months).
Working hours**	Standard, extended (for approximately twice a week during diaphragm walling for a total duration of approximately three months, and for once a month during other major concrete pours, and continuous (during tunneling for a duration of approximately 26 months, and during secondary lining of the tunnel for a duration of approximately eleven months; these activities are generally underground.
Construction transport mode	90% river
Peak monthly average barge numbers, and when	4/day; during tunnelling
Peak monthly average lorry numbers, and when	96/day; during tunnelling***
Approximate excavated material amount	1,644,500 tonnes
Permanent infrastructure above-ground	Combined ventilation column and electrical and control kiosk −6m (with minimum 4.0m) For the relocated concrete batching plant: Water tanks and wedge pit – 10m Aggregate storage bins, cement silos, concrete plant, water tanks, wedge pit, conveyor, blowing shed and hopper – 30m Tanks, bays and substation – 5m Offices, welfare and blowing shed – 5m

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for some of the period*

Heathwall Pumping Station

2.3.46 A work site is required to connect two existing CSOs, known as the Heathwall Pumping Station CSO and the South West Storm Relief CSO, to the Heathwall/South West Storm Relief connection tunnel, which would transfer flows into the main tunnel. The proposed development site is known as Heathwall Pumping Station, within the London Borough of Wandsworth and close to the London Borough of Lambeth.

2.3.47 The site itself comprises Thames Water's operational Heathwall Pumping Station, the designated safeguarded Middle Wharf and an area of the River Thames that includes the Battersea Barge restaurant.

2.3.48 The site is bounded to the north by the River Thames, to the east by open space and the Elm Quay residential block beyond, to the south by Nine Elms Lane, and to the west by the Tideway Industrial Estate (now a re-development site) and the proposed Kirtling Street site (see Vol 1 Plate 2.3.12).

Vol 1 Plate 2.3.12 Heathwall Pumping Station – aerial photograph

2.3.49 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.12.

Vol 1 Table 2.3.12 Summary features of proposed development at Heathwall Pumping Station

Feature	Information
Existing uses	The site consists of an operational Thames Water pumping station and the adjacent plot, Middle Wharf

Feature	Information
	that was a ready mix concrete depot but is currently unoccupied
Proposed uses	CSO interception and connection tunnel drive site
Approximate maximum site working area*	1.3 hectares
Approximate shaft depth to invert level	46m
Approximate shaft internal diameter	16m
Approximate construction start year, and duration	2017; three years
Construction activities and durations	Site Year 1 – site setup (approximately five months) Site Year 1 – drop shaft construction (approximately eight months) Site Year 1 to 2 - tunnelling (approximately four months) Site Years 2 to 3– construction of other structures (approximately 22 months) Site Year 3 – completion of works and site restoration (approximately six months).
Working hours**	Standard, and continuous during the construction of the short connection tunnel, (mainly below-ground), for a duration of approximately four months.
Construction transport mode	90% river
Peak monthly average barge numbers, and when	2/day; one month, during cofferdam construction
Peak monthly average lorry numbers, and when	18/day; one month, during cofferdam construction
Approximate excavated material amount	40,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the CSO drop shaft - 8m (with minimum 4m) Ventilation column(s) serving the SWSR interception chamber - 8m (with minimum 4m) Ventilation column(s) serving the Heathwall CSO interception chamber - 6m South West Storm Relief interception and flap valve chamber - 1.5m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

Albert Embankment Foreshore

2.3.50 A work site is required to connect the Brixton Storm Relief CSO and Clapham Storm Relief CSO to the main tunnel. The proposed development site is known as Albert Embankment Foreshore, which is located in the London Borough of Lambeth.

2.3.51 The site itself comprises an area of the foreshore of the River Thames parallel to Albert Embankment between Tintagel House and St George Wharf. The site is split into two sections: the northern section lies to the north of Lack's Dock and the southern section lies in the foreshore beneath and on either side of Vauxhall Bridge. The two sections would be connected by an underground connection culvert.

2.3.52 The River Thames surrounds the site to the north, south and west. The site is bounded to the east by the Thames Path/Riverside Walk and Albert Embankment beyond (see Vol 1 Plate 2.3.13).

Vol 1 Plate 2.3.13 Albert Embankment Foreshore – aerial photograph

2.3.53 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.13.

Vol 1 Table 2.3.13 Summary features of proposed development at Albert Embankment Foreshore

Feature	Information
Existing uses	The tidal Thames foreshore, close to Albert Embankment and to the east of Vauxhall Bridge. The site is bounded to the east by a high-rise office building. The SIS building is to south of the site.

Feature	Information
Proposed uses	CSO interception and connection tunnel drive site.
Approximate maximum site working area*	3.1 hectares
Approximate shaft depth to invert level	48m
Approximate shaft internal diameter	16m
Approximate construction start year, and duration	2017; three and a half years
Construction activities and durations	Site Year 1 – Site set up (approximately 12 months) Site Years 1 to 2 – Shaft construction (approximately ten months) Site Year 2 – Tunnelling (approximately three months) Site Years 2 to 3 – Construction of other structures (approximately 18 months) Site Years 3 to 4 – Completion of works and site restoration (approximately ten months).
Working hours**	Standard, extended (for approximately twice a week during diaphragm walling for a total duration of approximately four months, and for once a month during other major concrete pours) and continuous (required during construction of the connection tunnel for a duration of approximately three months, but these activities are generally underground).
Construction transport mode	90% river
Peak monthly average barge numbers, and when	4/day; one month, during cofferdam construction
Peak monthly average lorry numbers, and when	19/day; five months, during cofferdam construction***
Approximate excavated material amount	125,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the shaft = 8m (with minimum 4.0m) Ventilation column(s) serving the interception chamber = 6.0m Electrical and control kiosks = 2.5m (with minimum 1.5m)

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for some of the period*

Victoria Embankment Foreshore

2.3.54 A work site is required to connect the northern Low Level Sewer No. 1 to the main tunnel in order to control the Regent Street CSO. The proposed development site is known as Victoria Embankment Foreshore, which is located in the City of Westminster.

2.3.55 The site itself comprises an area of the foreshore of the River Thames and a section of pavement and carriageway of Victoria Embankment. A permanently moored vessel, the Tattershall Castle (a floating bar and restaurant), and two service moorings lie within the site.

2.3.56 The section of river wall within the site features Grade II listed sphinx seats, four 'sturgeon' lamp standards and associated catenery lighting. These features form part of the Victoria Embankment, which was constructed beside the River Thames when Sir Joseph Bazalgette's sewerage system was installed between 1864 and 1870.

2.3.57 The site is bounded to the north, east and south by the River Thames and to the west by Victoria Embankment, the pavement of which forms the Thames Path (see Vol 1 Plate 2.3.14).

Vol 1 Plate 2.3.14 Victoria Embankment Foreshore – aerial photograph

2.3.58 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.14.

Vol 1 Table 2.3.14 Summary features of proposed development at Victoria Embankment Foreshore

Feature	Information
Existing uses	The tidal Thames foreshore, to the south of Hungerford Bridge
Proposed uses	CSO interception and connection tunnel drive site
Approximate maximum site working area*	1.6 hectares
Approximate shaft depth to invert level	51m
Approximate shaft internal diameter	13m
Approximate construction start year, and duration	2016; four and a half years
Construction activities and durations	Site Year 1 – Site set up (approximately 12 months) Site Year 2 – CSO drop shaft construction (approximately eight months) Site Year 2 – Tunnelling (approximately four months) Site Years 3 to 4 – Construction of other structures (approximately 24 months) Site Years 4 to 5 – Completion of works and site reinstatement (approximately eight months).
Working hours**	Standard, and continuous for duration of connection tunnel construction (four months, primarily below-ground).
Construction transport mode	90% river
Peak monthly average barge numbers, and when	2/day; one month, during cofferdam construction
Peak monthly average lorry numbers, and when	14/day; one month, during cofferdam construction
Approximate excavated material amount	62,500 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the shaft = 8m (with minimum 4.0m) Ventilation column(s) serving the interception chamber = 6.0m Electrical and control kiosk(s) = 6.0m Electrical and control kiosk serving the interception chamber = 2.0m.

**Area within LLAU, including highway works*

***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

Blackfriars Bridge Foreshore

2.3.59 A work site is required to intercept the existing Fleet Main CSO and the northern Low Level Sewer No.1 and connect them to the main tunnel. The proposed development site is known as Blackfriars Bridge Foreshore, which is located in the City of London.

2.3.60 The site itself comprises two sections of the foreshore of the River Thames: the main site extends from Temple Stairs to Blackfriars Rail Bridge and the secondary site lies between Blackfriars Rail Bridge and the City of London School. The site also includes sections of the Blackfriars Bridge westbound off-ramp and areas of the pavement along Victoria Embankment and Paul's Walk.

2.3.61 The site is bounded to the north by Victoria Embankment/Blackfriars Underpass/Upper Thames Street and to the east, south and west by the River Thames (see Vol 1 Plate 2.3.15).

Vol 1 Plate 2.3.15 Blackfriars Bridge Foreshore – aerial photograph

2.3.62 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.15.

Vol 1 Table 2.3.15 Summary features of proposed development at Blackfriars Bridge Foreshore

Feature	Information
Existing uses	The tidal Thames foreshore, under and to the west of the Blackfriars road bridge. Blackfriars Millennium

Feature	Information
	Pier and part of the off-ramp from Blackfriars Bridge are also within the site
Proposed uses	CSO interception site – on line of main tunnel
	Blackfriars Millennium Pier
Approximate maximum site working area (both sites)*	3.9 hectares
Approximate shaft depth to invert level	53m
Approximate shaft internal diameter	24m
Approximate construction start year, and duration	2017; five years
Construction activities and durations	Site Year 1 to 2 - Site set up (approximately 16 months) Site Year 2 to 3 - Shaft construction (approximately ten months) Site Year 3 to 5 - Construction of other structures (approximately 26 months) Site Year 5 - Completion of works and site restoration (approximately seven months).
Working hours**	Standard, and extended (required for major concrete pours for CSO shaft construction including diaphragm wall panels, approximately twice a week during diaphragm walling for a total duration of approximately two and a half months, and once a month during other major concrete pours).
Construction transport mode	90% river
Peak monthly average barge numbers, and when	3/day; one month, during cofferdam removal
Peak monthly average lorry numbers, and when	46/day; during shaft construction***
Approximate excavated material amount	160,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the shaft = 8m (with minimum 4.0m) Ventilation column(s) serving the Northern Low Level Sewer No.1 = 6.0m Ventilation column(s) serving the Fleet connection culvert = 8m (with minimum 4.0m) Electrical and control kiosks at embankment level = 2.5m

Feature	Information
	Electrical and control kiosks under bridge ramp = 3.0m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

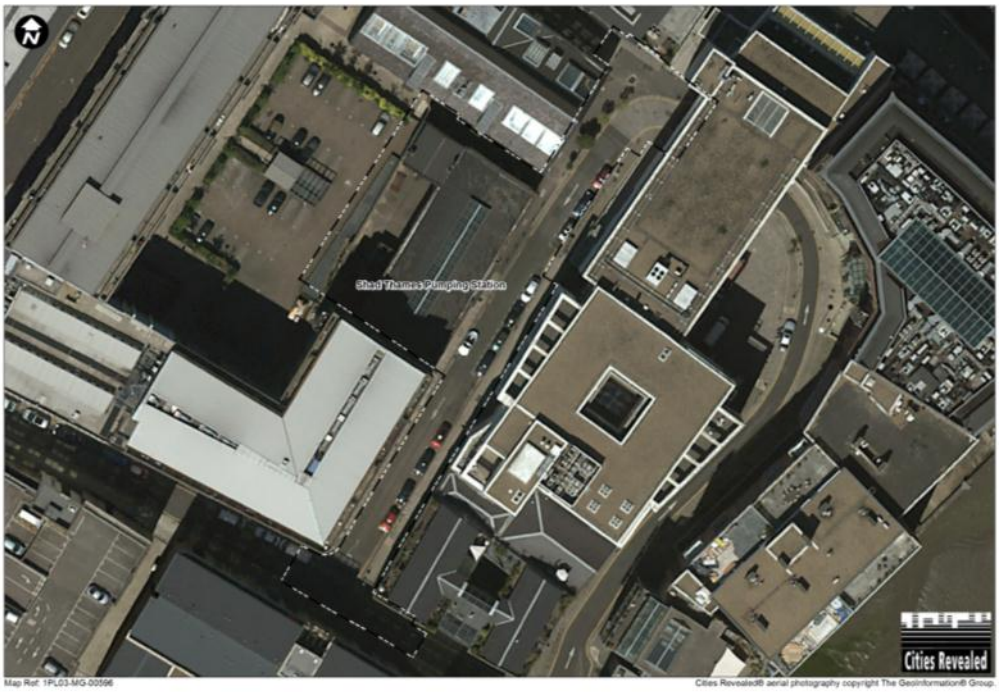
Shad Thames Pumping Station

2.3.63 A work site is required to mobilise capacity within the existing sewers upstream of the pumping station in order to store combined sewage (storm water mixed with wastewater). The proposed works would control the existing Shad Thames Pumping Station CSO without connecting it to the main tunnel. The proposed development site is known as Shad Thames Pumping Station, which is located in the London Borough of Southwark.

2.3.64 The site itself comprises the early 20th century Thames Water operational pumping station, the length of Maguire Street and its intersection with Gainsford Street. To the rear of the existing pumping station building is a narrow yard, which contains a number of ancillary buildings, including a facilities building that formerly accommodated the site superintendent, and various offices at the northern end.

2.3.65 The site is bounded to the north by the Grade II listed Wheat Wharf residential conversion, to the east by the Design Museum and Clove Building along Maguire Street, to the south by Tamarind Court, and to the west by a courtyard car park associated with Vanilla and Sesame Court (see Vol 1 Plate 2.3.16).

Vol 1 Plate 2.3.16 Shad Thames Pumping Station – aerial photograph



2.3.66 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.16.

Vol 1 Table 2.3.16 Summary features of proposed development at Shad Thames Pumping Station

Feature	Information
Existing uses	An operational Thames Water pumping station
Proposed uses	System modification to control CSO
Approximate maximum site working area*	0.2 hectares
Approximate shaft depth	N/A
Approximate shaft diameter	N/A
Approximate construction start year, and duration	2018; one and a half years
Construction activities and durations	Site Year 1 - Site preparation and demolition (approximately seven months) Site Year 2 – Main construction and completion (chambers, buildings, pipework and reinstatement) (approximately 12 months).
Working hours**	Standard
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	7/day; one month, during demolition
Approximate excavated material amount	600 tonnes
Permanent infrastructure above-ground	Electrical switchgear and facilities building = 9.5m

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

Chambers Wharf

2.3.67 A work site is required in order to construct the main tunnel and to receive the Greenwich connection tunnel, which would intercept three CSOs located in the boroughs of Greenwich and Lewisham. The proposed development site is known as Chambers Wharf, which is located in the London Borough of Southwark on the southern bank of the River Thames. The London Borough of Tower Hamlets lies to the north of the river.

2.3.68 The site itself comprises previously developed land that has now been cleared, an area of the River Thames foreshore and two small areas of roadway.

2.3.69 The site is bounded to the north by the River Thames, to the east by Loftie Street, to the south by Chambers Street and to the west by East Lane Bermondsey Wall West. The Thames Path currently runs around the site along Chambers Street and Loftie Street (see Vol 1 Plate 2.3.17)

Vol 1 Plate 2.3.17 Chambers Wharf – aerial photograph

2.3.70 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.17.

Vol 1 Table 2.3.17 Summary features of proposed development at Chambers Wharf

Feature	Information
Existing uses	A brownfield site, being a cleared re-development site, south of the tidal Thames.
Proposed uses	Main tunnel single drive to Abbey Mills Pumping Station, and single reception from Kirtling Street, and connection tunnel reception from Greenwich Pumping Station.
Approximate maximum site working area*	2.8 hectares
Approximate shaft depth to invert level	58m
Approximate shaft internal diameter	25m
Approximate construction start year, and duration	2015 (site preparation); six years
Construction activities and durations	Site Year 1 – site setup (approximately eight months)

Feature	Information
	Site Years 1 to 2 – main tunnel shaft construction (approximately 14 months) Site Years 2 to 4 - tunnelling (approximately 25 months) Site Years 4 to 5 – secondary lining (approximately eight months) Site Years 5 to 6 – construction of other structures (approximately 12 months) Site Year 6 – completion of works and site reinstatement (approximately five months).
Working hours**	Standard, extended (required for approximately twice a week during diaphragm walling for a total duration of approximately three months, and for once a month during other major concrete pours), and continuous (required during tunnelling for a duration of approximately 25 months, and during secondary lining of the tunnel for a duration of approximately eight months, generally underground).
Construction transport mode	90% river
Peak monthly average barge numbers, and when	3/day; one month, during cofferdam works
Peak monthly average lorry numbers, and when	55/day; during tunnelling***
Approximate excavated material amount	925,000 tonnes
Permanent infrastructure above-ground	Shaft extends 1m above existing ground level; Ventilation column(s) serving the shaft −8m (with minimum 4.0m) Electrical and control kiosk − 2.5m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

King Edward Memorial Park Foreshore

2.3.71 A work site is required to connect the North East Storm Relief CSO to the main tunnel. The proposed development site is known as King Edward Memorial Park Foreshore, which is located in the Shadwell ward of the London Borough of Tower Hamlets.

2.3.72 The site itself comprises the foreshore of the River Thames adjacent to King Edward Memorial Park and an area in the south of the park, including

hard-surfaced sections of the Thames Path, a small area of green space and part of the multi-purpose sports pitches to the west.

2.3.73 The site is bounded by King Edward Memorial Park and The Highway to the north, the residential Free Trade Wharf building to the east, the River Thames to the south, and by the Shadwell Basin Outdoor Activity Centre and Glamis Road to the west (see Vol 1 Plate 2.3.18).

Vol 1 Plate 2.3.18 King Edward Memorial Park Foreshore – aerial photograph

2.3.74 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.18.

Vol 1 Table 2.3.18 Summary features of proposed development at King Edward Memorial Park Foreshore

Feature	Information
Existing uses	The tidal Thames foreshore, directly south of and adjoining King Edward Memorial Park, a well maintained recreational area containing large grassed areas with pedestrian paths, tennis courts, bowling greens, a children's play area, a bandstand, and large paved seating areas along the Thames Path. There is also a park maintenance depot used by Trees for Cities
Proposed uses	CSO interception site – on line of main tunnel
Approximate maximum site working area*	2.0 hectares
Approximate shaft depth to	60m

Feature	Information
invert level	
Approximate shaft internal diameter	20m
Approximate construction start year, and duration	2016; three and a half years
Construction activities and durations	Site Year 1 – Site setup (approximately seven months) Site Years 1 to 2 – CSO drop shaft construction (approximately 12 months) Site Years 2 to 4 – Construction of other structures (approximately 20 months) Site Year 4 – Completion of works and site restoration (approximately six months).
Working hours**	Standard, and extended (required for approximately twice a week during diaphragm walling for a total duration of approximately three months, and for once a month during other major concrete pours).
Construction transport mode	90% river
Peak monthly average barge numbers, and when	2/day; one month during cofferdam construction, and one month during cofferdam removal
Peak monthly average lorry numbers, and when	41/day; during CSO drop shaft construction***
Approximate excavated material amount	130,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the shaft = 8m (with minimum 5.0m) Ventilation column(s) serving the interception chamber = 6.0m Electrical and control kiosk = 3.0m Local control pillar = 1.2m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Earl Pumping Station

2.3.75 A work site is required to connect the Earl Pumping Station CSO to the Greenwich connection tunnel in order to convey flows to the Chambers Wharf site, where they would be transferred into the main tunnel. The proposed development site is known as Earl Pumping Station, which is located in the London Borough of Lewisham and adjacent to the London Borough of Southwark to the north and west.

2.3.76 The site itself comprises Thames Water's Earl Pumping Station at the northern end of the site and four adjacent plots of industrial land at the southern end.

2.3.77 The site is bounded to the north by Chilton Grove and to the east by Yeoman Street. Occupied commercial/industrial units and a row of two-storey terraced houses with gardens lie adjacent to the southern site boundary and the first dwelling in the terrace sits adjacent to the site boundary. The site is bounded to the west by Croft Street (see Vol 1 Plate 2.3.19).

Vol 1 Plate 2.3.19 Earl Pumping Station – aerial photograph

2.3.78 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.19.

Vol 1 Table 2.3.19 Summary features of proposed development at Earl Pumping Station

Feature	Information
Existing uses	An operational Thames Water pumping station, and adjacent commercial and industrial warehouse buildings, including a two-storey office building
Proposed uses	CSO interception site – on line of connection tunnel
Approximate maximum site working area*	0.6 hectares
Approximate shaft depth to invert level	51m
Approximate shaft internal	17m

Feature	Information
diameter	
Approximate construction start year, and duration	2017; four years
Construction activities and durations	Site Year 1 – Site setup (approximately six months) Site Years 1 to 2 – CSO drop shaft construction (approximately 15 months) Site Years 2 to 3 – Construction of other structures (approximately 14 months) Site Years 3 to 4 – Completion of works and site restoration (approximately 14 months).
Working hours**	Standard, extended (twice a week during diaphragm walling for a total duration of approximately three months, and for once a month during other major concrete pours)
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	34/day; during CSO drop shaft construction***
Approximate excavated material amount	50,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the interception chamber = 6.0m Interception and valve chambers = 4.0m Drop shaft (parapet) = 5.0m Ventilation structure(s) over shaft = 7.0m Ventilation column(s) serving the interception chamber = 6.0m (minimum = 5.0m) Ventilation column(s) serving the shaft = 8.0m (minimum 4.75m)

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Deptford Church Street

2.3.79 A work site is required to connect the Deptford Storm Relief CSO to the Greenwich connection tunnel, which would transfer wastewater flows into the main tunnel. The proposed development site is known as Deptford Church Street, which is located in the London Borough of Lewisham and is also close to the London Borough of Greenwich to the north and east.

2.3.80 The site itself is triangular in shape and comprises an area of public open space and roadway.

2.3.81 The site is bounded to the north by Coffey Street, to the east by Deptford Church Street (A2209), and to the southwest by Crossfield Street (see Vol 1 Plate 2.3.20).

Vol 1 Plate 2.3.20 Deptford Church Street – aerial photograph

2.3.82 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.20.

Vol 1 Table 2.3.20 Summary features of proposed development at Deptford Church Street

Feature	Information
Existing uses	Open public space, located approximately 1km south of the tidal Thames, and 300m west of Deptford Creek
Proposed uses	CSO interception site – on line of connection tunnel
Approximate maximum site working area*	1.3 hectares
Approximate shaft depth to invert level	48m
Approximate shaft internal diameter	17m
Approximate construction start year, and duration	2016; three and a half years

Feature	Information
Construction activities and durations	Site Year 1 – Site setup (approximately three months) Site Years 1 to 2 – CSO drop shaft construction (approximately 12 months) Site Years 2 to 3 – Construction of other structures (approximately 20 months) Site Years 3 to 4 – Completion of works and site restoration (approximately 6 months)
Working hours**	Standard, and extended (for approximately twice a week during diaphragm walling for a total duration of approximately four months, and for once a month during other major concrete pours)
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	32/day; during CSO drop shaft construction***
Approximate excavated material amount	48,000 tonnes
Permanent infrastructure above-ground	Ventilation column(s) serving the drop shaft = 8m (with a minimum height of 6.0m) Ventilation column(s) serving the interception chamber = 6.0m Electrical and control kiosk = 3.0m (with a minimum height of 2.8m)

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Greenwich Pumping Station

2.3.83 A work site is required to connect the Greenwich Pumping Station CSO to the Greenwich connection tunnel and drive the connection tunnel to Chambers Wharf, where it would be connected to the main tunnel. The proposed development site is known as Greenwich Pumping Station, which is located in the Royal Borough of Greenwich immediately to the west of the administrative boundary with the London Borough of Lewisham.

2.3.84 The site itself comprises Thames Water's existing operational Greenwich Pumping Station and associated buildings, two railway viaducts that bisect the site, Phoenix Wharf and a builder's yard.

2.3.85 The site is bounded by the Brook Marsh Trading Estate, a vehicle repair garage and offices to the north, Norman Road to the east, Greenwich High

Road to the south, and Deptford Creek to the west (see Vol 1 Plate 2.3.21).

Vol 1 Plate 2.3.21 Greenwich Pumping Station – aerial photograph

2.3.86 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.21.

Vol 1 Table 2.3.21 Summary features of proposed development at Greenwich Pumping Station

Feature	Information
Existing uses	An operational Thames Water pumping station and surrounding land. There is also Phoenix Wharf currently a builders merchant and yards
Proposed uses	CSO interception and connection tunnel drive to Chambers Wharf
Approximate maximum site working area*	2.1 hectares
Approximate shaft depth to invert level	46m
Approximate shaft internal diameter	17m
Approximate construction start year, and duration	2016; five and a half years
Construction activities and durations	Site Year 1 – Site setup (approximately eight months) Site Years 1 to 2 – CSO drop shaft construction

Feature	Information
	(approximately 12 months) Site Years 2 to 4 - Tunnelling (approximately 20 months) Site Year 4 – Secondary lining (approximately eight months) Site Years 4 to 5 – Construction of other structures (approximately 18 months) Site Years 5 to 6 – Completion of works and site restoration (approximately eight months).
Working hours**	Standard, extended (approximately twice a week during diaphragm walling for a total duration of approximately four months, and once a month during other major concrete pours) and continuous (required for mainly below ground and tunnelling works for a total duration of approximately 20 months, and during secondary lining for a duration of approximately seven months).
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	77/day; during tunneling***
Approximate excavated material amount	320,000 tonnes
Permanent infrastructure above-ground	Drop shaft = 1.5m Access and ventilation structure(s) = 5.0m Interception and valve chambers = 1.5m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Abbey Mills Pumping Station

2.3.87 A work site is required to receive the main tunnel drive from Chambers Wharf and connect the main tunnel to the Lee Tunnel, which would transfer flows to Beckton Sewage Treatment Works for treatment. The proposed development site is known as Abbey Mills Pumping Station, which is located in the London Borough of Newham.

2.3.88 The new development would be concentrated within the southern and western areas of the pumping station site, near the Lee Tunnel project works and the existing Station F pumping station.

2.3.89 The site is bounded to the north and northeast by Abbey Mills Pumping Station, operational infrastructure and buildings, to the east and southeast by the Channelsea River and Abbey Creek, by the Prescott Channel to the west, and by Riverside Road to the northwest (see Vol 1 Plate 2.3.22).

Vol 1 Plate 2.3.22 Abbey Mills Pumping Station – aerial photograph

2.3.90 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.22.

Vol 1 Table 2.3.22 Summary features of proposed development at Abbey Mills Pumping Station

Feature	Information
Existing uses	To the south of the Abbey Mills Pumping Station within existing Thames Water site, flanked by watercourses
Proposed uses	Main tunnel single reception site. A short length of sprayed concrete lined main tunnel will be driven from this site from the Thames Tideway Tunnel project's shaft to the Lee Tunnel shaft
Approximate maximum site working area*	3.7 hectares
Approximate shaft depth to invert level	66m
Approximate shaft internal diameter	20m

Feature	Information
Approximate construction start year, and duration	2018; four years
Construction activities and durations	Site Year 1 – Site setup (approximately four months) Site Years 1 to 2 – Main tunnel shaft construction (approximately 15 months) Site Years 2 to 3 – Tunnelling / TBM reception and main tunnel secondary lining (approximately eight months) Site Year 3 - Construction of other structures (approximately seven months) Site Years 3 to 4 – Completion of works and site restoration (approximately ten months).
Working hours**	Standard, extended (required for approximately twice a week during diaphragm walling for a total duration of approximately four months, and for once a month during other major concrete pours) and continuous (required during tunnelling for a duration of approximately eight months but these activities are generally underground).
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	70/day; during main tunnel shaft construction***
Approximate excavated material amount	98,000 tonnes
Permanent infrastructure above-ground	Ventilation structure(s) (outlets) = 4.5m (with minimum 2.5m) Ventilation structure(s) (inlets) = 4.0m (with minimum 2.0m) Electrical and control kiosk = 2.5m Ventilation structure(s) = 5.0m (with minimum 2.0m) Ventilation column = 8.5m

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Beckton Sewage Treatment Works

2.3.91 A work site is required to install new infrastructure to transfer combined sewage from the main tunnel system (including the Lee Tunnel) to Beckton Sewage Treatment Works for treatment, and to connect a new siphon tunnel to the proposed Lee Tunnel overflow shaft. The proposed development site is at Beckton Sewage Treatment Works, which is located in the Beckton ward of the London Borough of Newham.

2.3.92 The site itself comprises two areas within the southern and western sections of the operational Beckton Sewage Treatment Works compound. The western section of the site comprises land under development for the Lee Tunnel and Beckton Sewage Treatment Works Extension scheme. The southern section comprises an area of hardstanding and operational infrastructure associated with the sewage treatment works bounded by internal access roads.

2.3.93 Beckton Sewage Treatment Works is bounded by the Alfred's Way trunk road to the north, Barking Creek to the east, the River Thames to the south, and by Royal Docks Road, Hornet Way and Armada Way to the west (see Vol 1 Plate 2.3.23).

Vol 1 Plate 2.3.23 Beckton Sewage treatment Works – aerial photograph

2.3.94 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.23.

Vol 1 Table 2.3.23 Summary features of proposed development at Beckton Sewage Treatment Works

Feature	Information
Existing uses	An operational Thames Water sewage treatment works
Proposed uses	To transfer flows for treatment
Approximate maximum site working area*	15.9 hectares
Approximate depth of siphon tunnel inlet shaft to invert level	32m
Approximate internal diameter of siphon tunnel inlet shaft	9m
Approximate depth of siphon tunnel outlet shaft to invert level	31m
Approximate internal diameter of siphon tunnel outlet shaft	7m
Approximate construction start year, and duration	2016; four and a half years
Construction activities and durations	Site Year 1 – site setup (approximately two months) Site Year 1 - shaft construction (approximately ten months) Site Years 1 to 2 - tunnelling including secondary lining (approximately nine months including two months for secondary lining) Site Years 2 to 4 – construction of other structures (approximately 18 months) Site Years 4 to 5 – completion of works and site restoration (approximately 16 months).
Working hours**	Standard, extended (required approximately twice a week during diaphragm walling for a total duration of approximately four months [two months per shaft]) and continuous (required during the TBM drive for a duration of approximately seven months and during secondary lining for a duration of approximately two months).
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	25/day; during tunneling***

Feature	Information
Approximate excavated material amount	38,000 tonnes
Permanent infrastructure above-ground	Superstructure over siphon inlet shaft = 8.0m Siphon inlet valve chamber(s) = 1.5m Siphon outlet shaft = 2.0m Siphon outlet valve chamber(s) = 3.5m Discharge chamber(s) = 2.0m Grit removal gantries = 5.0.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*
**** peak reached during this period, although the peak monthly average lorry numbers may be significantly less for much of the period*

Minor works sites – Bekesbourne Street

2.3.95 A minor work site is required to control the Holloway Storm Relief CSO and divert combined sewage flows into the northern Low Level Sewer No.1. These works avoid the need to connect the CSO to the main tunnel. The proposed development site is known as Bekesbourne Street, which is located in the London Borough of Tower Hamlets.

2.3.96 The site itself comprises a section of Bekesbourne Street and its junction with Ratcliffe Lane.

2.3.97 The site is bounded to the north by Limehouse Station and the Docklands Light Railway, to the east by John Scurr House (a six-storey block of flats), and to the south and west by three to four-storey residential blocks of flats and the John Scurr Community Centre (see Vol 1 Plate 2.3.24).

Vol 1 Plate 2.3.24 Minor works site at Bekesbourne Street – aerial photograph

2.3.98 Summary features of the proposed development site at this site are presented in Vol 1 Table 2.3.24.

Vol 1 Table 2.3.24 Summary features of proposed development at minor works sites – Bekesbourne Street

Feature	Information
Current CSO discharge frequency and volume	N/A
Predicted CSO discharge frequency and volume	N/A
Existing uses	Predominantly on a private road and adjacent car parking
Proposed uses	System modification to control CSO
Approximate maximum site working area*	0.1 hectares
Approximate chamber depth to invert level	8m
Approximate chamber dimensions	4.6 by 5.0m
Approximate construction start year, and duration	2019, seven months
Construction activities and	Site year 1: site preparation, shaft construction, other

Feature	Information
durations	structures and completion of works/site restoration.
Working hours**	Standard
Construction transport mode	Road
Peak monthly average barge numbers, and when	N/A
Peak monthly average lorry numbers, and when	5/day; for one month, during excavation
Approximate excavated material amount	700 tonnes
Permanent infrastructure	Ventilation column(s) = 6m Electrical and control kiosk(s) = 2.5m.

**Area within LLAU, including highway works*
***Detailed information on the classification and description of working hours is provided in the CoCP Part A, Section 4.2 (see Appendix A)*

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.01**

Volume 1: Introduction to the Environmental Statement

Alternatives to the project

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

Hard copy available in

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January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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3 Alternatives to the project

3.1 Introduction

3.1.1 This section describes the main alternatives considered to the proposed development, including alternatives to a tunnel solution, alternative tunnel routes and alternative sites. Details are presented on how environmental and other factors have influenced the decisions taken in respect of the proposed development.

3.1.2 Section 3.2 provides a summary of the national policy context in respect of alternatives to the Thames Tideway Tunnel. Section 3.3 then presents an outline of the strategic alternatives (tunnel and non-tunnel) to a storage and transfer solution to the CSO discharges. Section 3.4 considers various transfers and storage tunnel options. Section 3.5 considers the various tunnel route alternatives which have been considered whilst Section 3.6 considers the alternative drive strategies and alternative main construction sites which have been considered. Finally, Section 3.7 considers the alternatives to each of the CSO sites which are included within the proposed development. Alternative layouts or designs at individual sites are covered within Section 3 in each of the site volumes of the *Environmental Statement*.

3.1.3 These sections describe the main alternatives and main reasons for selecting the proposed development for which development consent is sought in order to address the requirements of the 2009 EIA Regulations and the relevant policy guidance contained in the NPS. This part of the *Environmental Statement* does not, however, seek to provide a full chronological summary of the various studies and work undertaken over the previous decade. For a full understanding of the background to the project development the following references are relevant:

a. TTSS Steering Group Report February 2005 (Thames Water, 2005)[29]

b. TTSS Solutions Group Working Report Volumes I and II, February 2005 (Thames Water, 2005)[30]

c. Thames Tideway Tunnel and Treatment, Solutions Working Group Report (December 2006)[31]

d. Thames Tideway Tunnel and Treatment Summary Report Tackling London's Sewer Overflows, Executive Summary (2007)[32]

e. Regulatory Impact Assessment - sewage collection and treatment for London (Defra, March 2007)[33]

f. Lee Tunnel Environmental Statement (Alternatives chapter)[34]

g. The National Policy Statement for Waste Water

h. *Final Report on Site Selection Process* (Thames Water 2013, a document accompanying this application).

3.2 National policy context

Nationally Significant Infrastructure Project status

3.2.1 The Thames Tideway Tunnel is an NSIP under Section 14 of the 2008 Act by virtue of the Infrastructure Planning (Waste Water Transfer and Storage) Order 2012 which came into force on 23 June 2012. NSIP status gives primacy within the planning process to the NPS and thereby to the conclusions contained therein in respect of the national need for the Thames Tideway Tunnel and in respect of the consideration of alternatives. These elements of the NPS are described in the following section.

National Policy Statement for Waste Water

3.2.2 The NPS forms an essential element of the consideration of alternatives since it provides a conclusion on the need for the Thames Tideway Tunnel as well as providing guidance on how the Examining Authority and decision-maker should consider alternatives. The paragraphs within the NPS which are considered directly relevant to need in this context NPS paragraphs 2.6.33-2.6.34) are given below.

a. "Thames Tunnel conclusion on need: It is inappropriate to "do nothing": a sustainable long term solution is required to address the unacceptable levels of untreated sewage which are discharged into the River Thames and which have significant environmental, social and economic impacts. The Government considers that detailed investigations have confirmed the case for a Thames Tideway Tunnel as the preferred solution."

b. "The examining authority and the decision maker should undertake any assessment of an application for the development of the Thames Tunnel on the basis that the national need for this infrastructure has been demonstrated. The appropriate strategic alternatives to a tunnel have been considered and it has been concluded that it is the only option to address the problem of discharging unacceptable levels of untreated sewage into the River Thames within a reasonable time at a reasonable cost. It would be for Thames Water to justify in its application the specific design and route of the project that it is proposing, including any other options it has considered and ruled out."

3.2.3 The NPS also provides guidance on the way in which the *Environmental Statement* should address alternatives (at paragraphs 3.4.1 - 3.4.3) as follows.

a. "Part 2 of this NPS provides an overview of the strategic alternatives both to the general nationally significant need for waste water infrastructure and to the project-specific need for the Thames Tunnel…. These strategic alternatives do not need to be assessed by the examining authority or the decision maker.

b. "This NPS has not considered the detail of specific sites, routes, designs, layout, construction programmes or operational processes for

these particular projects, which are the responsibility of the applicant to determine, in conjunction with the Government's environmental and economic regulators."

c. "The Environmental Statement should include an outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects."

Infrastructure Planning (EIA) Regulations 2009

3.2.4 Under the 2009 EIA Regulations, the *Environmental Statement* must contain "an outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects" (see regulation 2(1) and paragraph 18 of Part 1 of Schedule 4).

3.2.5 Given these requirements, it has been considered essential within this Environment Statement to provide an outline of the strategic alternatives (in addition to consideration of tunnel routes and sites), despite the fact that the NPS states that "These strategic alternatives do not need to be assessed by the examining authority or the decision maker" (see paragraph 3.2.3 above).

3.3 Strategic alternatives

Review of strategies

Types of strategy

3.3.1 There are a number of possible strategies for dealing with the unacceptable discharges of sewage into the Thames from the CSOs. The Thames Tideway Strategic Study (Steering Group Report February 2005, Section 0.5 and others), divided these into four main strategies based upon the location of the solution.

3.3.2 These are:

a. addressing the problem at source before the sewerage system by exclusion or control of rainwater run-off into the sewerage system, eg, source control, detention ponds and other similar Sustainable Urban Drainage Systems (SUDS) techniques

b. addressing the problem within the sewerage system itself by attenuation within the system or by the provision of new on- or off-line tanks and separation of the sewerage system

c. addressing the problem in the river using remedial measures eg, by increasing dissolved oxygen with river craft and treatment with hydrogen peroxide

d. addressing the problem at the CSOs themselves (by capture and / or storage and / or treatment).

3.3.3 Each of these four main strategies is reviewed below. Strategy (d) is the proposed strategy which includes storage and transfer tunnels and the

other three strategies are therefore considered to be alternative strategies within this review of alternatives. In each case the conclusions of the relevant technical studies undertaken by Thames Water are given. The conclusion on each strategy presented within the NPS is also provided. The Mayor of London provided comment on strategic alternatives at the Section 48 stage (July – October 2012) and these are also given where relevant below.

Addressing the problem at source (Sustainable Urban Drainage Systems)

3.3.4 Given that the UK is in breach of the UWWTD in respect of the Beckton and Crossness catchments, an important consideration in determining whether a particular alternative is suitable is the time which would be taken for it to be implemented. This alternative strategy, which would require the extensive use of Sustainable Urban Drainage Systems, has therefore been dismissed by Thames Water on this criterion since it would take many years to be implemented at a sufficient scale to represent a real alternative to the tunnel proposals. This alternative strategy has also been discounted because of a lack of available space in London, the disruption that would be caused for any meaningful retro-fit of SUDS and the disproportionate cost even to provide a partial solution.

3.3.5 The NPS (paragraph 2.6.27-2.6.28) concludes as follows:

a. "**Preventing the rainwater from entering the sewerage system.** The highly impermeable nature of the London urban area generates massive volumes of rainfall run-off which must be collected and disposed of quickly and efficiently to prevent flooding of properties. The existing mechanism is via drains and gullies into the sewerage system."

b. "Sustainable Drainage Systems can play a key role in increasing capacity and resilience in London's sewer network by reducing the volume entering sewers. However, in this instance simultaneous retrofit of all London's properties and the sewerage systems to the required level would be disproportionally expensive compared with a traditional drainage solution. It has also been demonstrated that retrofitting would not provide sufficient reductions in CSO spill frequency to meet the objectives for the Tideway and comply with the UWWTD."

3.3.6 The Mayor of London provided the following comments on this strategy in 2012:

a. "Rainwater storage and Sustainable Drainage (SUDS) options would also be a more expensive option as a very large number of local storage areas would be required to deal with the scale of rainwater attenuation/diversion that is required. The Mayor feels that technically this could be achieved, but it would take many years and significant financial incentives and new legislative requirements. The Mayor has heard evidence, notably from the City of Philadelphia, that a sustainable drainage approach is being taken seriously elsewhere, but he recognises that the circumstances, both physical and

regulatory/legislative are different in London. Therefore at present the Mayor accepts that the Tunnel based solution is the most viable, particularly bearing in mind the requirement to comply with the Urban Waste Water Treatment Directive."

b. The Mayor does however remain convinced that increasing the permeability of London's urban fabric will, over time, reduce the volume of rainwater entering the combined sewer system. This will help to reduce the volumes that are discharged to the Thames Tunnel and give it a buffer against one of the projected effects of climate change which is to see more intense rainstorms. Therefore the Mayor will pursue these SUDS and rainwater storage/harvesting options wherever possible in line with the London Plan Sustainable Drainage Hierarchy (Policy 5.14) and he has a number of programmes such as Drain London and Greenstreets which are already supporting the implementation of such projects on a localised scale."

Addressing the problem within the sewage system

3.3.7 As with addressing the problem at source (see above), the second alternative strategy, which would use sewer separation, storage tanks or other forms of increasing capacity of the existing system, was dismissed by Thames Water on the basis that it would take many years to be implemented at a sufficient scale to represent a real alternative to the tunnel proposals.

3.3.8 This alternative strategy has also been discounted as it would require very extensive landtake to support several storage tanks (and tunnels) which would be of much greater volume than one large tunnel. Furthermore attenuation may lead to unacceptable sewer flooding, on- or off-line storage does not meet the quality objectives cost effectively and sewer separation at a large scale is not considered technically or economically feasible.

3.3.9 The NPS (paragraphs 2.6.29-2.6.30) concludes as follows:

a. "**Providing extra capacity within the sewerage system**. The existing sewers could be enlarged or duplicated, or storage could be provided but the sewerage system is so large and complex with so many cross connections that most of the network would need to be enlarged to prevent any CSOs from discharging. There are no particular pinch-points where enlargements could be carried out that would benefit the whole system. Substantial duplication/enlargement to most of the sewers would entail massive construction work throughout inner London, enormous disruption and extremely high costs. The environmental objectives for the Thames cannot be met by other alternatives at a lower cost."

b. "**Converting the combined drainage to a separate drainage system.** This would involve the provision of a completely new network of sewers approximately 12,000km in length and every existing property would require connecting to the new system. Cost and disruption would be very high and might lead to large numbers of

misconnections, which would create a legacy of problems, pollution and further work."

3.3.10 The Mayor of London provided the following comments on this strategy in 2012:

a. “The investigation, albeit at a high level into the separation of the sewer system revealed that almost every street in the central and inner area of London would need to be dug up and new sewers laid. This would be excessively expensive, considerably more so than the current proposal. It would also result in large scale disruption to streets, which are already suffering from large amounts of road works and would take a very long time to implement. This option was therefore discounted. The Mayor remains open to the view that separation may be appropriate in certain locations as opportunities arise and this will help to reduce the amount of surface water entering the combined sewer system. Additionally separated systems also have their own problems of mis-connected sewers causing pollution as is found in many of the outer London tributary rivers where there is a separated sewerage system.”

Addressing the problem within the river

3.3.11 The third alternative strategy has been discounted as these measures can only be short term reactive measures. Once the CSO discharges are in the river the polluting effects and associated environmental damage can only be partially ameliorated and the sewage derived litter problems cannot be adequately addressed. It therefore fails to provide a true solution as the pollution has already occurred and in this context is not a true alternative.

3.3.12 The NPS concludes (paragraph 2.6.26) that:

a. "A non-intervention strategy is considered not to be feasible due to the frequency and volume of discharges of untreated waste water and the consequent environmental impacts. There is an existing system to mitigate reduced dissolved oxygen levels following discharges in the River Thames using the "Thames Bubbler" oxygenation craft as well as hydrogen peroxide dosing. This has helped prevent wide scale fish mortality but is not considered to be a sustainable or complete solution in the long-term. A number of other measures have also been considered and rejected."

3.3.13 The Mayor of London provided the following comments on this strategy in 2012:

a. “The option of in river treatment of sewage overflows was quickly discounted as this does not address the problem and given the dynamic tidal nature of the Thames will always be minimally effective.”

Addressing the problem at the CSOs

3.3.14 The fourth strategy, addressing the problem at the CSOs has been identified as providing the only feasible solution to the CSO problem. Thames Water has concluded that it is the only strategy which (i) is capable of providing a complete solution and (ii) does not require an

extensive retro-fit or replacement of existing systems, which would be impractical to implement.

3.3.15 The following (paragraphs 2.6.24-2.6.25 from the NPS) provide policy support for this conclusion as follows:

a. "The Thames Tideway Strategic Study was convened in early 2000 and reported in 2005 and comprised Department of the Environment, Transport and Regions (DETR), Thames Water, the Environment Agency, and the Greater London Authority, with Ofwat as an observer, and an independent chair, Professor Chris Binnie. The Thames Tideway Strategic Study produced a detailed investigation of the environmental impact of sewage overflows, identified objectives for improvement and proposed potential solutions. This was followed by an independent review for Ofwat published in February 2006, and further reports completed by Thames Water in the second half of 2006. Defra produced a 'Regulatory impact assessment -sewage collection and treatment for London' in March 2007 reviewing these various reports. This concluded that Thames Water should be asked to proceed urgently with a tunnel-based solution to resolve the problems in London."

b. "The proposed London Tideway Improvements scheme solution comprises:

   i an early-phase 7km spur tunnel (the 'Lee Tunnel') between Abbey Mills and Beckton to pick up the large overflows at Abbey Mills CSO. Work has started on this tunnel after planning permission was granted following an application under the Town and Country Planning Act. In addition, work has begun on a major extension to Beckton Sewage Treatment Works, to treat the contents of the Thames and Lee Tunnels.

   ii A large diameter spine tunnel (The 'Thames Tunnel') - likely to be around 25km long running from west London, through central London picking up unsatisfactory overflows discharging direct to the tidal Thames. The Thames Tunnel is the subject of this part of the NPS."

c. "These improvement works are required so that obligations under the Urban Waste Water Treatment Directive can continue to be met. The European Commission has referred the UK to the Court of Justice asserting breaches of the Directive in London (and Whitburn in North East England). The Commission's position is that the level of overflows is excessive and that an adequate sewerage and collection system should have been in place by the end of 2000. The construction of the Tunnel is a solution to address the discharges into the Thames and is part of the defence."

3.3.16 The UK was required to be in compliance with the Urban Waste Water Treatment Directive by 31 December 2000, and on 18 October 2012 the European Court of Justice handed down a judgement in the case of proceedings brought by the European Commission that determined that by

failing to control the discharges in the Beckton and Crossness catchments the UK Government was in breach of the Directive.

3.3.17 In addition, the NPS states (paragraph 2.6.31):

a. "**Intercepting the CSOs at their point of discharge to the river and conveying to a suitable site for treatment (the preferred option**). This strategy, which has developed into the Thames Tunnel, would allow the CSOs to continue to operate but would collect the discharges and transfer them to a new treatment facility prior to discharge to the river. There are many advantages in adopting this strategy because it causes minimum disruption to the existing system and to inner London thus making it less expensive to deliver and, because it specifically captures CSO discharges, its effectiveness is assured and more predictable."

3.3.18 The Mayor of London provided the following comments on this strategy in 2012:

a. "..Therefore at present the Mayor accepts that the Tunnel based solution is the most viable, particularly bearing in mind the requirement to comply with the Urban Waste Water Treatment Directive.", and

b. "..Therefore at present a tunnel based solution appears to be the most effective way forward. This is why the London Plan expresses specific support for the principle of a Thames Tunnel. However, the Mayor will retain an open mind in respect of the feasibility and deliverability of alternative solutions."

Options for dealing with the CSO discharges at the CSOs

3.3.19 As determined above, the strategy of dealing with the CSO problem at the CSOs was identified by Thames Water as the preferred wider strategy. Within this wider strategy, there are a number of sub-options and these are reviewed below.

Storage and transfer tunnel

3.3.20 This option, which represents the proposed approach, would intercept CSO flows along the tidal Thames and would store them within a tunnel with transfer and pump out at a controlled rate for treatment at a suitable location. This has been identified as the only solution which combines capture of the unacceptable discharges with primary and secondary treatment thus meeting water quality objectives and capacity requirements in an appropriate way.

3.3.21 The approach is supported by the National Policy Statement since it combines capture of the unacceptable discharges with primary and secondary treatment sufficient to achieve the water quality objectives.

3.3.22 The storage and transfer tunnel solution has been compared to other alternative options within the wider strategy of dealing with the discharges at the CSOs as follows.

Transfer tunnel

3.3.23 This alternative would intercept CSO flows in a similar manner to the proposed development, would capture them within a tunnel and would then carry them downstream to a high capacity pumping station and screening plant for untreated discharge to the lower reaches of the tidal Thames. This option was discounted as it does not provide primary or secondary treatment and so only moves the problem further down the tidal Thames. This option would also have a high capacity pumping requirement with high peaks of energy consumption.

Multiple screened outlets

3.3.24 This alternative would use multiple, purpose built pumping and screening stations connected via collection and distribution tunnels to intercept flows from the CSOs with subsequent discharge to the tidal Thames. This option was discounted as it does not provide primary or secondary treatment and would have a major impact at screening plant and pumping station locations with high land take requirements.

Multiple screened outlets with storage

3.3.25 This alternative is a hybrid of a storage tunnel and storage shafts (see below). It would incorporate a second tunnel to store the first flush of storm water that would be stored and pumped out for treatment at a sewage works. It was however discounted as it only provides primary / secondary treatment for a proportion of the discharges. As for multiple screened outlets above, major impacts would occur at screening plant and pumping station locations with high land take requirements.

Storage shafts

3.3.26 This alternative would require large storage shafts constructed in the foreshore next to the CSOs and incorporate a static screen whereby two thirds of storm water is screened and returned to the tidal Thames and the remainder is pumped back into the sewerage system for treatment. This approach was discounted and it provides only primary / secondary treatment for a proportion of the discharges and would generate severe impacts to large areas of foreshore at storage shaft locations. The option would also be disproportionately expensive compared to other options.

Storage tanks at each CSO

3.3.27 This alternative (based on a recent Berlin prototype) would involve using prefabricated tubes anchored to piles within the river. The tubes would provide temporary storage which would then need to be pumped back into the existing sewage network when capacity allowed.

3.3.28 This approach has been discounted as the storage volumes are small compared to the overflow volumes for the CSOs, each storage location would require its own pumping station and odour treatment facilities. This option would also have a significant environmental impact on the foreshore, would adversely affect navigation and would increase flood risk.

Screening at individual CSOs

3.3.29 This option would involve the installation of screening plant immediately adjacent to or upstream of the CSO discharge locations but was discounted as it does not provide primary or secondary treatment and would generate major impacts at screening plant locations. It does not represent an alternative in respect of the need to improve dissolved oxygen in the tidal Thames.

Displacement

3.3.30 This option is based on a conduit normally left full and discharging to a large wetlands area over an extended period. The option was discounted as no suitable site is available and there would be substantial potential for septicity of sewage arising from the extended period of retention.

Comparisons of strategic alternatives with storage tunnel options

3.3.31 Although the TTSS concluded in 2006 that a storage and transfer tunnel was the only suitable option to address the CSO discharges, in order to ensure that the most cost-effective solution was being progressed to address the requirements of the UWWTD, the storage and transfer tunnel solution was tested again by Thames Water against non-tunnel alternatives in 2009. Two main groups of alternatives were considered in these studies:

a. separation of Foul and Storm Water collection networks and

b. retrofitting Source Control and SUDS.

3.3.32 Other approaches such as hybrid solutions / partial separation, real time control, screening and dispersed storage were also re-examined to see if these approaches (which could be at least partial alternatives) could contribute to the cost effectiveness of the project. The following tables (Vol 1 Table 3.3.1 and Vol 1 Table 3.3.2 (these are Tables 5.9 and 5.10 from the *Needs Report* submitted with the application) summarise the results of the studies in relation to separation and SUDS and compare these two alternatives against three route options (see Section 3.5 for further details) for the Thames Tideway Tunnel:

Vol 1 Table 3.3.1 Advantages and disadvantages of options

Option	Advantages	Disadvantages
• Full-length storage tunnel (Abbey Mills route)	• Complies with UWWTD and environmental objectives • Cheapest option • Least disruption to businesses and residents • Is capable of being delivered by target	• More spills (4) and greater volume discharged in typical year than other tunnel options • High operating costs • High carbon footprint

Option	Advantages	Disadvantages
	date of 2020 • Use of river for materials transportation where practicable and economic • Least amount of land needed • Adaptable and flexible	
• Full-length storage tunnel (Rotherhithe route)	• Complies with UWWTD and environmental objectives • Is capable of being delivered by target date of 2020	• High operating costs • High carbon footprint
• Full-length storage tunnel (River Thames route)	• Complies with UWWTD and environmental objectives • Least spills (2) of tunnel options • Is capable of being delivered by target date of 2020	• High operating costs • High carbon footprint
• Separation using new storm water sewers or new foul sewers (with storm water in existing combined network)	• Sewer flooding relief can be incorporated	• Cannot comply with UWWTD or environmental objectives • Very disruptive to business, residents and transportation • Not possible to complete by 2020, with over 35 year implementation period • Very expensive • High whole life operating costs, affected by need for estimated 48 or more new pumping stations • High carbon footprint
• Sustainable	• Desirable and	• Cannot comply with

Option	Advantages	Disadvantages
drainage systems (SUDS)	mandatory for new build developments, but difficult to retrofit • Enhances the environment • Can manage surface water flooding • Low whole life operating costs • Low carbon footprint	UWWTD or environmental objectives • Very disruptive to business, residents and transportation • Not possible to complete by 2020, with over 30 year implementation period • Very expensive • Complex logistical processes for planning permission • Legal and regulatory obstacles to implementation

3.3.33 For each option, the advantages and disadvantages as well as the cost estimates are set out in the table below (Vol 1 Table 3.3.2):

Vol 1 Table 3.3.2 Summary of main options and estimated costs

Option	Response to need	Estimated costs* (£ millions)	Comments
Full-length storage tunnel (Abbey Mills route)	Complies with UWWTD and environmental objectives	3,588 (accuracy range +/- 10% to +/- 25%)	• Most cost effective scheme. • Spills at CSOs limited to 4 events in a typical year. • Least disruption to residents, businesses and transportation. • Is capable of being delivered by target date of 2020.
Full-length storage tunnel (Rotherhithe route)	Complies with UWWTD and environmental objectives	4,310 (accuracy range +/- 10% to +/- 25%)	• Spills at CSOs limited to 2 events in a typical year. • Is capable of being delivered by target date of 2020.
Full-length storage	Complies with UWWTD and	4,336 (accuracy	• Spills at CSOs limited to 2 events

Option	Response to need	Estimated costs* (£ millions)	Comments
tunnel (River Thames route)	environmental objectives	range +/- 10% to +/- 25%)	in a typical year. • Is capable of being delivered by target date of 2020.
Separation using new storm water sewers or new foul sewers (with storm water in existing combined network)	New sewerage designed for 1 in 30 storms.	14,000 (variance +50% to -30%)	• Cost significantly greater than tunnel option. • Significant disruption to residents, businesses and transportation. • Prolonged timescale for completion; eg, 30 years at £400m spend per annum, so not capable of complying with UWWTD and environmental objectives by 2020.
Sustainable drainage systems (SUDS)	In certain catchments a 37% reduction in impermeable area potentially contributing to CSO discharges could be achieved.	13,000 (variance +50% to -30%)	• High cost and time to implement. • Reduction in impermeable area still results in more than ten** CSO spills in a typical year. • Not able to achieve compliance with requirements of UWWTD. • Not applicable to inner city catchments and many practical limitations to implementation.

** Cost base date of December 2008.*

***Maximum spill frequency allowed by other EU Member States regarding their interpretation of the requirements of the UWWTD.*

3.3.34 On the basis of the above comparisons, both SUDS and system separation were again discounted in 2009 as viable alternatives (as they had previously been within the TTSS).

3.3.35 The full tunnel route options identified above are discussed in detail in Section 3.5.

3.4 Storage and transfer tunnel options

Background

3.4.1 There are a number of possible alternatives to the proposed single tunnel development. These include various combinations of shorter tunnels and well as a number of possible tunnel routes. This section considers the former with particular reference to studies which were undertaken during 2006. Tunnel routes are considered further in Section 3.5.

3.4.2 In July 2006, the then Secretary of State for Climate Change and the Environment wrote to Thames Water, requesting, inter alia, the development, assessment and costing of two principal storage and transfer tunnel options for tackling the CSOs. These were:

a. a 32km tunnel to intercept all unsatisfactory CSOs (including Abbey Mills) along the length of the tidal Thames from Hammersmith to Beckton Sewage Treatment Works

b. two tunnels comprising a West tunnel (from Hammersmith to Heathwall with pump out to the existing sewer network) and a separate East tunnel (connecting Abbey Mills to Beckton, either directly or via Charlton).

3.4.3 The second group of options, based on a two tunnel solution were derived from an alternative solution (to a single tunnel from Hammersmith to Beckton), presented in a report prepared by Jacobs Babtie[35] at the request of Ofwat. This alternative involved two short tunnels (west and east tunnels), a new treatment facility near Heathwall Pumping Station in central London, screening plant and enhanced primary treatment plant at Abbey Mills.

Options assessed

3.4.4 Thames Water brought together key stakeholders in a number of working groups to develop options, one of which was the Planning and Environment Working Group including the GLA, LTGDC, the Association of Local Government, LBN and the EA. The purpose was to develop the planning and environmental aspects of these options and assist in their assessment. The two main tunnel options (and variants) were subsequently defined using the following nomenclature:

a. Option 1a - Full length storage tunnel, 7.2m diameter with Abbey Mills link joining at Greenwich;

b. Option 1b - Full length storage tunnel, 6m diameter, otherwise as 1a;

c. Option 1c - Full length storage tunnel, 7.2m diameter, tunnels with direct Abbey Mills link;

d. Option 2a - West tunnel, 7.6m diameter and East tunnel, 13m diameter;

e. Option 2b - West tunnel, 7.6m diameter and East tunnel, 10m diameter with supplementary additional treatment capacity; and

f. Option 2c - West tunnel, 7.6m diameter and East tunnel (via Charlton), 10m diameter.

3.4.5 The results of the tunnel optioneering study were presented in a report to Defra in December 2006[36]. For each option, this report included technical reviews, consideration of planning and environmental constraints (and benefits), potential for early part delivery in respect of the Abbey Mills CSO (the Lee Tunnel) and a Cost Benefit Analysis. The options are reviewed in the paragraphs that follow and this is then summarised in Vol 1 Table 3.4.1.

Option 1a - Full tunnel, 7.2m diameter, Abbey Mills link via Charlton

3.4.6 This option would meet long term water quality objectives and dissolved oxygen objectives and would have lower odour risks since better flushing would be possible. The construction risks would be higher because of uncertain geology in the Lower Lee Valley area. Risks would be lower for a 7.2m tunnel compared to a larger tunnel (eg, 10m) tunnel. It would not support a standalone project for the Abbey Mills CSO since a non-Thames Water site would need to be acquired and in addition it would require the part completion of the Thames Tideway Tunnel.

Option 1b - Full tunnel, 6m diameter, Abbey Mills link via Charlton

3.4.7 This option would meet long term water quality objectives, although it would result in some more untreated releases of sewage than for a larger diameter tunnel. Dissolved oxygen objectives would be met with this option and there would be lower odour risks since better flushing would be possible. As for Option 1a described above, the construction risks would be higher because of uncertain geology in the Lower Lee Valley area. Risks would be lower for a 6m tunnel compared to a larger tunnel such as considered under Option 1a. It would not support a standalone project for the Abbey Mills CSO since a non-Thames Water site would need to be acquired and it would also require the part completion of the Thames Tideway Tunnel.

Option 1c - Full tunnel, 7.2m diameter, direct Abbey Mills link

3.4.8 This option would meet both long term water quality objectives and dissolved oxygen objectives. Odour risks would be reduced due to better flushing being possible. This option would also avoid the uncertain geology in the Lower Lee Valley area and due to its smaller diameter construction risks would be lower. In addition, this option supported a standalone project for the Abbey Mills CSO as all surface sites would be owned by Thames Water and no additional land acquisition would be necessary. This standalone project which captures the Abbey Mills CSO became the Lee Tunnel and is currently under construction.

Option 2a - West tunnel, 7.6m diameter and East tunnel, 13m diameter, direct Abbey Mills link

3.4.9 This option avoids the uncertain geology in the Lower Lee Valley area which lowers construction risks and there would be no additional land acquisition necessary as all surface sites required would be owned by Thames Water, thereby supporting a standalone project for the Abbey Mills CSO. However, this option would not meet long term water quality objectives because 25% (by volume) of CSOs would not be captured. Dissolved oxygen objectives would only be met initially but not in the long term by 2020. This option would also have higher odour risks as flushing would be more difficult and due to its larger diameter tunnels construction risks would be higher.

Option 2b - West tunnel, 7.6m diameter and East tunnel, 10m diameter with supplementary additional treatment capacity, direct Abbey Mills link

3.4.10 As Option 2a described above, this option avoids the uncertain geology in the Lower Lee Valley area lowering construction risks. There would be no additional land acquisition necessary for this option as all surface sites required would be owned by Thames Water, thereby supporting a standalone project for the Abbey Mills CSO. However, this option would not meet long term water quality objectives because 25% (by volume) of CSOs would not be captured and dissolved oxygen objectives would only be met initially but not by 2020. This option would also have higher odour risks as flushing would be more difficult. Although lower than for Option 2a, construction risks would be higher for this option due to its larger diameter tunnels.

Option 2c - West tunnel, 7.6m diameter and East tunnel, 10m diameter, Abbey Mills link via Charlton

3.4.11 This option, as options 2a and 2b described above, avoids the uncertain geology in the Lower Lee Valley area, thereby lowering construction risks. Long term water quality objectives would not be met by this option because 25% (by volume) of CSOs would not be captured and dissolved oxygen objectives would only be met initially but not by 2020. This option would also have higher odour risks as flushing would be more difficult and construction risks would be higher due to its larger diameter tunnels. In addition, there would be land acquisition issues with this option as not all land required would be owned by Thames Water. Therefore this option would not support a standalone project for the Abbey Mills CSO.

Summary of Options

3.4.12 The following table (Vol 1 Table 3.4.1) summarises the six options reviewed above:

Vol 1 Table 3.4.1 Summary assessment of options December 2006

Option	Long-term WQ objectives ?	DO Objectives?	Odour Risk?	Construction Risk?	Supports stand-alone project for Abbey Mills CSO?
1a	yes	yes	lower - better flushing	higher - lower Lee Valley geology lower - small tunnel diameter	no - land acquisition issues & requires part completion of Thames Tideway Tunnel
1b	yes - but more untreated releases	yes	lower - better flushing	higher - lower Lee Valley geology lower - small tunnel diameter	no - land acquisition issues & requires part completion of Thames Tideway Tunnel
1c	**yes**	**yes**	**lower - better flushing**	**lower - avoids lower Lee Valley** **lower - small tunnel diameter**	**yes - all surface sites owned by TW**
2a	no - 25% (by volume) of CSOs not captured	(yes) - initially but not by 2020	higher - difficult to flush	lower - avoids lower Lee Valley higher - larger tunnel diameter	yes - all surface sites owned by TW
2b	no - 25% (by volume) of CSOs not captured	(yes) - initially but not by 2020	higher - difficult to flush	lower - avoids lower Lee Valley higher - larger tunnel diameter	yes - all surface sites owned by TW
2c	no - 25% (by volume) of CSOs not captured	(yes) - initially but not by 2020	higher - difficult to flush	higher - lower Lee Valley geology higher - larger tunnel diameter	no - acquisition issues

Conclusion

3.4.13 As summarised in the table above and in the preceding paragraphs, the December 2006 study by Thames Water concluded that Option 1c (highlighted) would deliver the maximum benefits, with construction risks

that are considered manageable, and enabled an early phased solution (through the direct Abbey Mills - Beckton link). Each variant of the two tunnel solution (and so the Jacobs Babtie[37] alternative) was rejected on the basis of the above reasons and notably the failure to meet long-term water quality objectives.

3.4.14 Option 1c was based on two schemes comprising a 7.2m diameter Storage Tunnel linking CSOs from Hammersmith to Beckton (the 'Thames Tideway Tunnel') and a 7.2m diameter Storage Tunnel linking Abbey Mills - Beckton (the 'Lee Tunnel'). The Lee Tunnel is currently (2013) under construction.

Ministerial approval

3.4.15 In March 2007, Defra published a Regulatory Impact Assessment (RIA)[38] in connection with collection and treatment of sewage in London. The RIA, concluded in paragraph 11.7, by saying:

a. "Having considered the recent report by TW, and a range of issues including legal obligations, compliance risks, timetables, cost benefit analysis, affordability and feasibility, it is recommended that a phased, single tunnel approach, which addresses all the unsatisfactory overflows, is the minimum required to meet our obligations. It is therefore proposed that TW are asked to proceed urgently with the development and implementation of a scheme which reduces and limits pollution from storm water overflows (starting with Abbey Mills pumping station) of the Beckton and Crossness sewer system in the most cost effective way. Such an approach, which may be based on option 1c, offers the quickest prospect of making a significant impact on the volume of the discharges, and it would convey a sense of urgency and commitment to take measures to comply as soon as possible."

3.4.16 In his letter of 17 April 2007, the then Minister, Ian Pearson, endorsed the Option 1 type approach in order to make progress toward compliance with the Urban Waste Water Treatment Directive (UWWTD) (and associated duties under the Water Industry Act and the Urban Waste Water Treatment (England and Wales) Regulations 1994) as quickly as possible and requested that Thames Water makes provision for the design, construction and maintenance of a scheme for the collecting systems connected to Beckton and Crossness sewage treatment works.

3.4.17 Thames Water actioned the Minister's request to make provision for the design, construction and maintenance of a scheme involving a full length storage tunnel. It has planned the strategy for implementation and appointed a London Tideway Tunnels Delivery Team (LTTDT) to deliver the Lee Tunnel and the provision for the Thames Tideway Tunnel (then known as the "Thames Tunnel") - the London Tideway Tunnels. The Lee Tunnel is currently (2013) under construction with target completion in 2015.

3.5 Thames Tideway Tunnel routes

Background

3.5.1 During 2009 - 2010, a range of routes were considered for the route of the Thames Tideway Tunnel. In broad terms the route must start in west London and follow the route of the River Thames eastwards, intercepting those CSOs identified for interception and ensuring flows can be transferred to Beckton Sewage Treatment Works for treatment. The precise route is influenced by the locations of the sites required to construct the tunnel and intercept the CSOs.

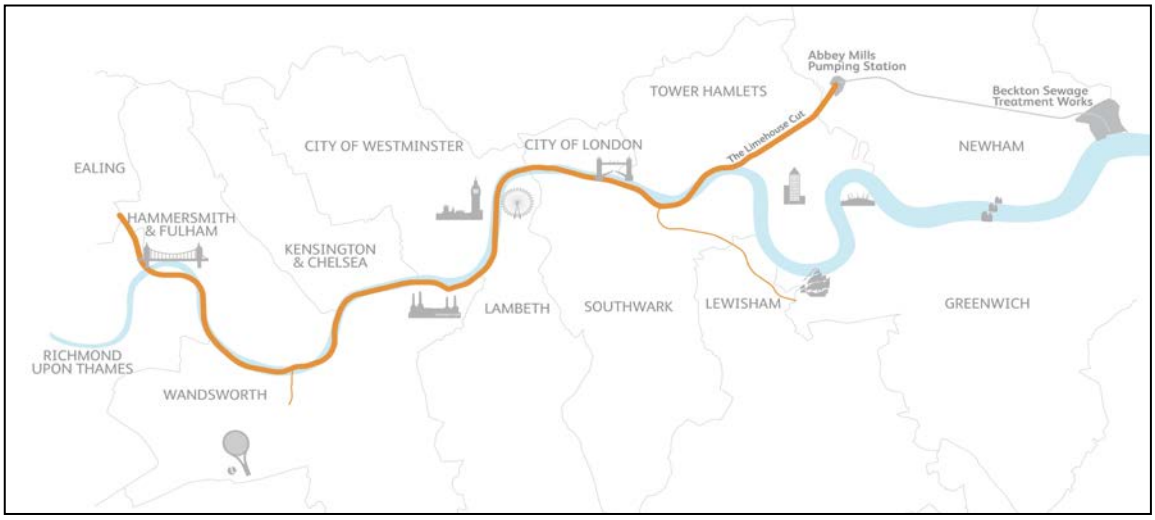
Thames Tideway Tunnel alignments

3.5.2 Three tunnel routes were compared against each other using a range of criteria from the five disciplines of engineering, planning, environment, community and property, using professional judgement to balance the issues and compare the effects of the tunnel routes, and their associated construction sites. In so doing, consideration of the overall impact of each of the tunnel routes drew upon the site selection work outlined in Sections 3.6 and 3.7 of this volume.

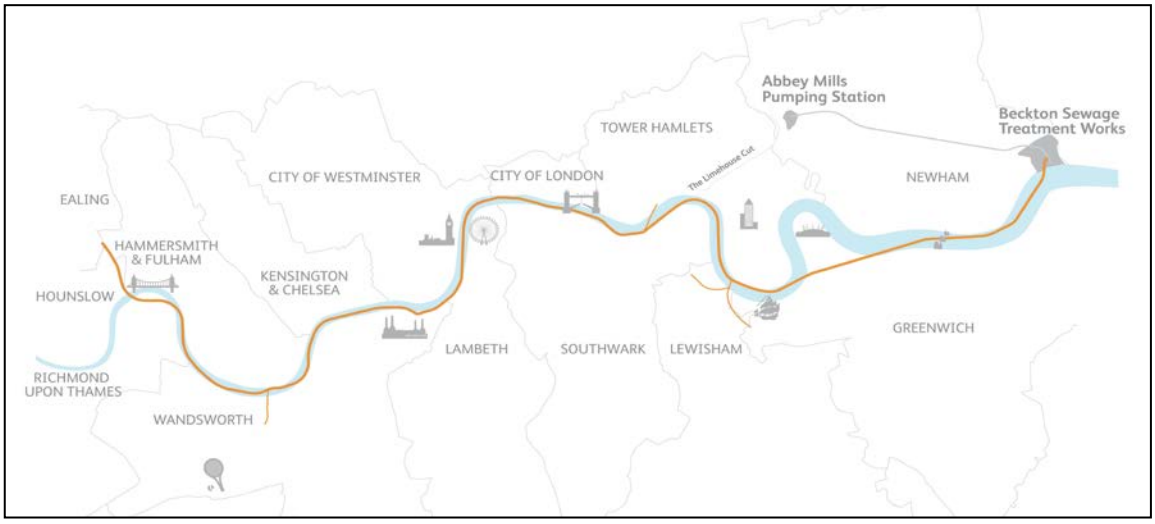
3.5.3 The three alternative alignments for the Thames Tideway Tunnel considered in detail and consulted on are shown on Vol 1 Plate 3.5.1

Vol 1 Plate 3.5.1 Alternative alignments of Thames Tideway Tunnel

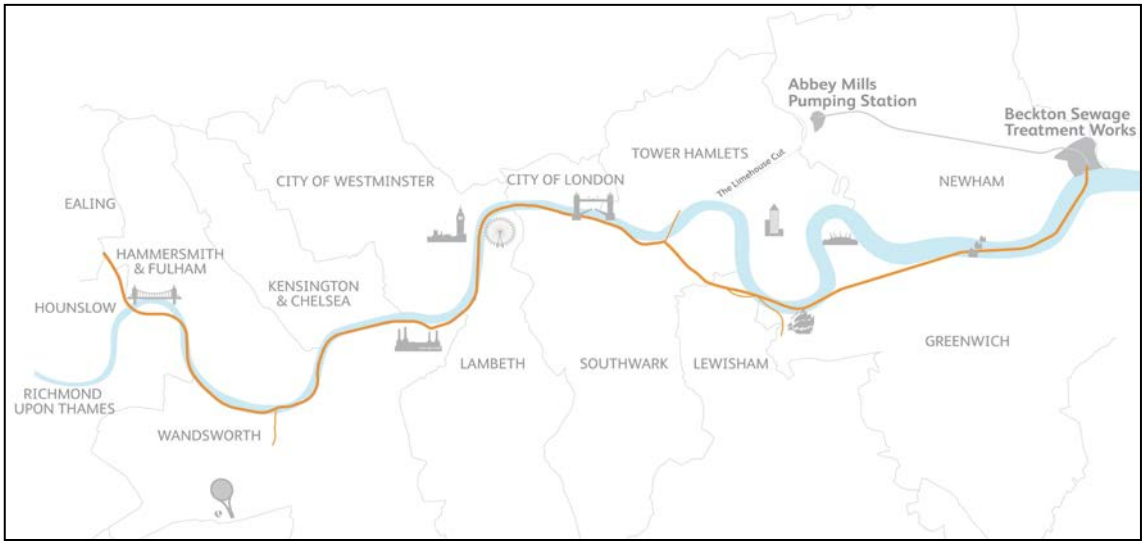
Abbey Mills route



River Thames route



Rotherhithe route



Abbey Mills route

3.5.4 The Abbey Mills route is the proposed route submitted for development consent. It differs from the two other route alternatives by connecting the Thames Tideway Tunnel to the head of the Lee Tunnel at Abbey Mills. The opportunity to connect the Thames Tideway Tunnel to the head of the Lee Tunnel arose as that tunnel was slightly deeper than originally proposed because of a need to avoid difficult geological features along the route.

3.5.5 The upstream tunnel system would be the same as the River Thames or Rotherhithe tunnel alignments (described below) from the interception of Acton Storm Relief Sewer as far as Rotherhithe, but would then veer northeast to Abbey Mills. CSOs to be intercepted downstream of Rotherhithe would connect back to the main tunnel by connection tunnels except for Charlton Storm Relief CSO which would be addressed by local modifications and an alternative means of control.

3.5.6 The route is up to 9km shorter than the two other alternative alignments and therefore would need fewer construction sites and hence would involve less construction work and fewer construction related environmental impacts. It would use less carbon and would be considerably cheaper. It would capture slightly less sewage than the alternatives, however, the overall river water quality would still be significantly improved and would meet the project objectives.

The River Thames Route

3.5.7 The alternative River Thames route would largely follow the river from west London downstream crossing the Greenwich Peninsula, underground, and on to Beckton Sewage Treatment Works. The tunnel system would intercept CSO discharges from the Acton Storm Relief Sewer at the upstream end by connection tunnel to the main tunnel at Hammersmith Pumping Station.

3.5.8 This alternative would follow the River Thames from west London to the Greenwich Peninsula, where it would take a shortcut below land. It would then continue beneath the River Thames all the way to Beckton Sewage Treatment Works in the east. This is the longest of the two tunnel route alternatives.

3.5.9 It would capture the most untreated sewage from the CSOs along the river and would meet the project objectives, but would also be the most expensive. This is the route that was identified in the December 2006 report to Government (note that "the Abbey Mills route" (see above) was not available at that time because a shallower Lee Tunnel alignment was then proposed which would have precluded connection with the deeper Thames Tideway Tunnel.

Rotherhithe route

3.5.10 The alternative Rotherhithe route would cut across both the Greenwich and the Rotherhithe Peninsulas. The tunnel system would intercept CSO discharges from the Acton Storm Relief Sewer at the upstream end by connection tunnel to the main tunnel at Hammersmith, and would connect

to the overflow shaft at Beckton Sewage Treatment Works at the downstream end, exactly as for the tidal Thames route.

3.5.11 This alternative route would follow the River Thames from west London as far as the Rotherhithe Peninsula, where it would then pass below the land, before continuing along the River Thames, under the Greenwich Peninsula and then on to Beckton Sewage Treatment Works.

3.5.12 This option would not capture as much of the overflowing sewage as the River Thames route as it would be slightly shorter.

Summary

3.5.13 The main elements of the three tunnel alignment reviewed above are summarised in the table below. Additional details on all three routes are also presented in Section 3.4 (Vol 1 Table 3.4.1).

Vol 1 Table 3.5.1 Key aspects of the three tunnel alignment alternatives

Category	River Thames route	Rotherhithe route	Abbey Mills route
Main tunnel length (km) (7.2km diameter)	31.3	29.6	22.3
Number of main shafts (diameters)	10 (20m to 25m)	8 (20m to 25m)	5 (20m to 25m)
Connection tunnel lengths (km) (diameters)	8.6* (2.2 to 4.5m)	8.6* (2.2m to 4.5m)	8.8* (2.2m to 4.5m)
Total storage volume (million m^3 (includes Lee Tunnel)	1,855	1,781	1,505
Number of CSOs directly connected	22	22	21
Number of CSOs otherwise connected or locally addressed	12	12	13
Maximum number of spill events in a typical year per CSO (from the Category 1 and 2 CSOs in the Beckton and Crossness catchments)	2	2	4

** These lengths all exclude some of the smaller connection tunnel lengths that were included within the summation of connection tunnel lengths.*

3.5.14 All three Thames Tideway Tunnel routes would meet all four of the EA water quality standards. Also:

a. All three routes would deliver low residual CSO spills during the typical year. For the accepted typical year, the number of CSO spills at controlled locations is no more than four at the largest CSO locations and generally less than three at most locations.

b. The three routes (with sewage treatment works capacity improvements, the Lee Tunnel and 2021 conditions) would capture between 97% and 98% of the estimated CSO discharge volumes in a typical year rainfall.

c. None of the routes demonstrate any benefit over the others regarding water quality, significant CSO event or volume captured.

Reasons for selection of the Abbey Mills route

3.5.15 The majority of the main tunnel alignment is common for the River Thames, Rotherhithe and Abbey Mills routes; the project from Acton to the Southwark area being identical for all three routes. Tunnel alignments vary west of Southwark, but some of the preferred sites (at CSO interception locations) are common. Therefore, of the sites which would be required for the River Thames and Rotherhithe routes and the sites required for the Abbey Mills route, most sites are common to all three routes.

3.5.16 An assessment was made in 2010 by the engineering, planning, environment, community and property disciplines, who considered the overall construction project, nature of the affected sites and their surroundings, and other strategic and cumulative issues. The results of the assessments, where these are still relevant to the proposed route, are summarised below.

Engineering

3.5.17 The Abbey Mills route is 9km and 6.7km less than the River Thames and Rotherhithe route alternatives respectively. The cost of the Abbey Mills route has been estimated as approximately £700m less than the two alternatives which would have similar costs. Despite having a reduced internal volume, compared to the two alternatives, the hydraulic performance of the Abbey Mills route is still compliant with the requirements of the UWWTD.

3.5.18 From an overall health and safety hazard perspective, the reduction in scope for the Abbey Mills route reduces the likelihood of construction related risks. In addition, the River Thames and Rotherhithe alternatives routes would drive through water-bearing chalk with much higher ground water pressures which would increase wear on the TBM and the risks to personnel carrying out TBM maintenance. Other greater tunnelling risks associated with the River Thames and Rotherhithe routes would include driving through a much greater length of flint bearing chalk, a greater number of fault zones and the construction of more deep shafts and CSO connections. However, the Abbey Mills route follows an alignment at the top of the chalk, close to the underside of the Thanet Sands along the

Limehouse Cut, which could make TBM face interventions hazardous and complex.

3.5.19 The substantial reduction in construction scope associated with a shorter tunnel length and fewer main construction sites, coupled with tunnelling through less hazardous ground results in the Abbey Mills route being a safer construction choice. The reduced scope was also considered to reduce overall procurement risk by placing less stress on the procurement chain. Finally, these reasons, together with lower costs for a solution considered acceptable in relation to the requirements of the UWWTD were all engineering reasons to conclude that the Abbey Mills route is preferred.

Planning

3.5.20 The strategic comparison of the three tunnel routes focussed on a number of recurring cumulative planning considerations. These comprise the nature of the affected land (greenfield, previously developed and foreshore), the impact upon safeguarded wharves and the River Thames, and the prospects for enacting current planning permissions and emerging proposals.

3.5.21 The loss and potential replacement of public open space is an issue common to all routes, particularly within areas of deficiency. The potential for conflict with regeneration proposals is an issue for all routes, but the Abbey Mills route requires fewer large-scale sites that are earmarked for regeneration.

3.5.22 These considerations affect all three routes, but the Abbey Mills route incorporates comparatively fewer greenfield and previously developed sites than either the River Thames or Rotherhithe alternative routes. As a result, the overall number of sites which would affect public open space, employment, regeneration and safeguarded wharf designations, is fewer, as well as the number of sites that would require mitigation against potential policy conflicts. The level of impacts upon sites with extant permission or forthcoming proposals is also reduced in respect of the Abbey Mills route. The potential for a reduced cumulative impact upon these planning considerations is the main planning reason to conclude that the Abbey Mills route is preferred.

Environment

3.5.23 As noted above, the Abbey Mills Route is 9km and 6.7km less than the River Thames and Rotherhithe routes respectively. This means that the Abbey Mills Route would generate less excavated material, require less material for its construction and need less energy in its construction. The Abbey Mills main tunnel route would therefore have a lower 'carbon footprint' than the two other alternative routes.

3.5.24 The Abbey Mills main tunnel route would be dependent on fewer sites than either of the alternative routes and would therefore be expected to generate the least site related environmental effects across the project.

3.5.25 The sites required for the Abbey Mills route also impact the fewest sites with medium-high archaeological potential and the fewest sites with valued townscape character and/or River Thames frontage than the other two

routes. The lower number of sites required for the Abbey Mills route would lead to the least disturbance of contaminated ground and lower cumulative noise impacts than the other two routes.

3.5.26 The Abbey Mills route would require fewest in-river jetty structures to be built, although all three route options impact the foreshore in some way. The Abbey Mills route has a greater number of foreshore sites, which is likely to increase the permanent mitigation requirements for this route in relation to environmental and ecological issues.

3.5.27 The sites required for the Abbey Mills Route are also likely to impact fewer built heritage receptors. The lower number of sites required for the Abbey Mills route would lead to less disturbance of contaminated ground and result in adverse air quality impacts at fewer sites than the other two alternative routes.

3.5.28 Given that fewer environmental effects were anticipated in respect of the Abbey Mills route it was therefore identified as the preferred main tunnel route from an environmental perspective.

Community

3.5.29 From a community impacts perspective, all three of the routes would have the potential to impact on a number of sensitive receptors.

3.5.30 Although possible to determine the exact numbers of people or households affected, cumulatively the Abbey Mills route would be likely to impact on fewer residential neighbourhoods due to the shorter tunnel length and the route alignment. Community cohesion and the health and wellbeing of local people could be impacted by the use of a number of sites required to construct all three routes.

3.5.31 All three routes would require the use of sites which may impact on the local economy through the displacement of active businesses. On balance, the Abbey Mills route appears preferable from this perspective as this route would not require the Charlton site, and therefore involves the relocation of fewer businesses overall.

3.5.32 In particular, the omission of several sites from the Abbey Mills route reduces the compensation costs and also reduces the impact of the project on the community.

3.5.33 Overall, from a community impacts perspective, there are advantages and disadvantages to all three route alignments. No route avoids significant likely community impacts, but the cumulative socio-economic impacts are likely to be slightly fewer with the Abbey Mills route. The Abbey Mills main tunnel route would be dependent on fewer sites than either the River Thames route or Rotherhithe route, and should therefore generate less site related community impact when considered at the project wide level and so was therefore identified as the preferred main tunnel route from a community perspective.

Property

3.5.34 All three routes would give rise to property issues and the sites associated with routes fall within the following categories: development sites, local

authority owned parks, occupied industrial estates, Thames Water property and foreshore sites.

3.5.35 For the Abbey Mills route considerations are broadly the same as for the other routes, except that the number of main sites was reduced to five, with one development site and the industrial estate at Charlton being removed from consideration. Beckton Sewage Treatment Works would also be also replaced by Abbey Mills PS.

3.5.36 In cumulative terms the property issues associated with the Abbey Mills route were therefore less, although a number of major issues were relevant to all three routes, including potentially high acquisition costs of development sites, establishing the ability to secure the rights required to public parks, and the need to provide compensation for relocated businesses.

3.5.37 The Abbey Mills Route was therefore identified as the preferred main tunnel route from a property perspective.

Conclusion

3.5.38 All three tunnel routes have advantages and disadvantages, but the Abbey Mills route has several considerable advantages and was selected as the proposed route. The substantial reduction in construction scope associated with the shortest tunnel length and fewest main construction sites, coupled with tunnelling through less difficult ground, results in the Abbey Mills route being the safest and least cost construction choice. It has been judged to have the least environmental impact, slightly fewer community impacts, fewest property issues and lower planning risks than the alternatives. This route is the basis of the project described in this volume (Section 2) and assessed in the *Environmental Statement*.

3.5.39 The recommendation to the Government, in 2010, for the UK to be able to meet the requirements of the Urban Waste Water Treatment Directive (beyond the construction of the Lee Tunnel and the sewage treatment works upgrades underway at Mogden, Crossness and Beckton Sewage Treatment Works) was a preferred scheme for the Thames Tideway Tunnel based on:

a. the Abbey Mills Route

b. a main tunnel, 23km long with an internal diameter of 7.2m

c. the direct interception of 21 CSOs

d. the indirect interception of a further 12, and a local solution for the remaining CSO

3.6 Main construction sites and drive strategy

3.6.1 The main tunnel would be constructed using TBMs. A series of main tunnel sites is required to allow the TBMs to start from shafts known as drive shafts, and to be taken out at shafts known as reception shafts (see Section 2.2). In addition there is a need for sites to intercept the CSOs and connect them to the main tunnel, in some instances via connection tunnels. These latter sites are covered in Section 3.7.

3.6.2 In order to construct the tunnel, the site selection process undertaken to identify sites needed to consider a number of factors when identifying main tunnel sites and the drive strategy, including, but not limited to, the following:

a. A maximum tunnel drive length was determined to be approximately 12 km, based on health and safety and risk considerations.

b. Long tunnel drives which took more than 324 weeks were excluded since this would compromise the programme.

c. It is strongly preferable to use a specific type of TBM for a particular geology so requiring careful consideration at significant changes in geology.

d. It is strongly preferable to have main sites and particularly main drive sites immediately adjacent to the river to enable the conveyance of materials in particular excavated materials.

e. It is strongly preferable to combine a CSO site with a main tunnel site if possible, since this reduces the total number of sites required, potentially reducing both disruption and costs.

f. The potential impact of a site's use on the local community and environment during construction and operation of the tunnel was considered.

g. The potential availability of suitable sites was considered taking into account the possible acquisition risks and costs.

3.6.3 The site selection process (see the *Final Report on Site Selection Process* that accompanies the application) used a sieving approach to short-list potentially suitable sites along the proposed route. In order to enable construction sites for the main tunnel and the related drive strategy to be identified, nine zones were identified along the length of the route between Acton and Abbey Mills. The zones were based on the geographical locations of short-listed main tunnel sites along the line of the River Thames as shown below. All of the shortlisted main tunnel sites fell within one of the zones. The most suitable site was identified within each zone and a series of comparisons were then made of the potential drive options (ie, how the most suitable sites could be connected) to identify a preferred scheme.

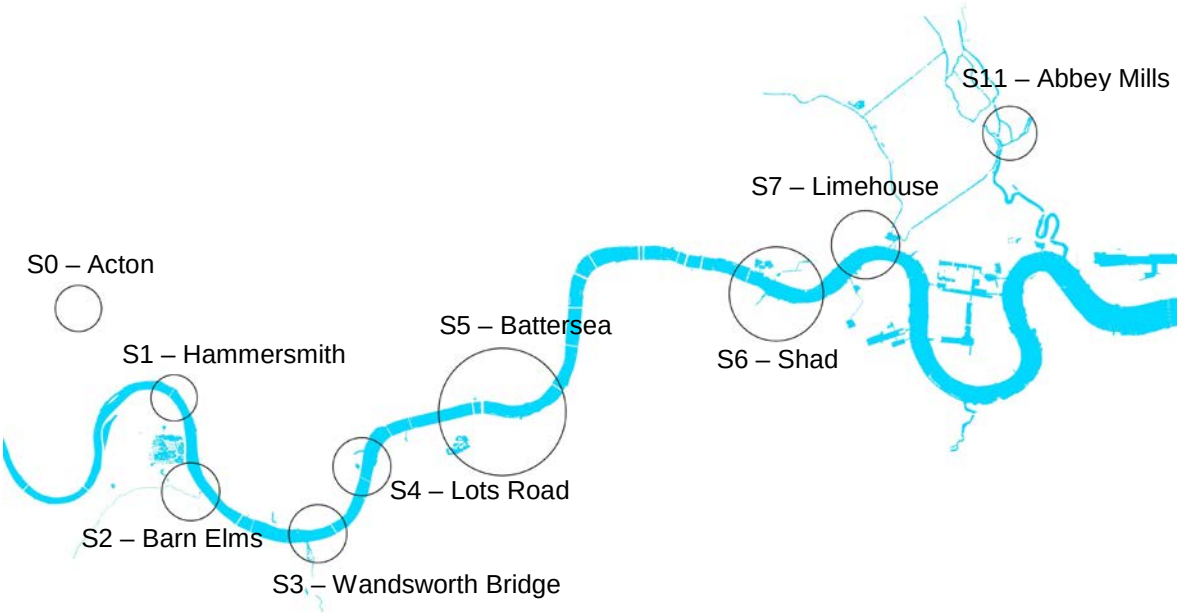
3.6.4 All drive options considered required a main tunnel site in zone S0 (Acton), and zone S11 (Abbey Mills) because these represent the ends of the proposed main tunnel. In addition there would need to be a long connection tunnel between S6 or S7 and Greenwich Pumping Station to collect interceptions from the three CSOs at Greenwich, Earl and Deptford and transfer them to the main tunnel. A short connection tunnel would also be required linking a site in zone S3 or nearby with two CSOs to the south along the River Wandle / Bell Lane Creek (Buckhold Road CSO and Bell Lane Creek CSO, both on the Frogmore Storm Relief sewer)

3.6.5 A main tunnel site is also required in zone S6 or S7 because of the major break in tunnel geology in this area (Lambeth group to the west and chalk

to the east) which require different types of TBM for the majority of the in the drive lengths east and west of this geological change.

3.6.6 The status of short-listed sites was frequently reviewed during the site selection process and no suitable main tunnel sites were available within zone S1 (Hammersmith) or zone S4 (Lots Road). Note that Zones S8, S9 and S10 are not relevant to the chosen Abbey Mills tunnel route and are not shown on the diagram below (Vol 1 Plate 3.6.1).

Vol 1 Plate 3.6.1 Main tunnel shaft zones



3.6.7 In order to identify the drive strategy for building the tunnel, the suitability of the shortlisted sites within each zone to act as a main tunnel drive or reception shaft was assessed. Based on these comparisons, a combination of a preferred main tunnel drive sites and reception sites were identified to construct the preferred scheme.

3.6.8 Within the assessment that follows, which draws upon the information available in the *Final Report on Site Selection Process* (which accompanies the application), the preferred site identified within each zone or group of zones (and the alternative shortlisted sites within the zone) are considered first. Based on the preferred sites, the preferred drive strategy is then identified and the alternatives to it are then considered.

3.6.9 The assessment only considers sites which were short-listed. Other sites which did not progress to this stage are not reviewed since they do not generally represent viable alternatives.

3.6.10 It is important to note that during the site selection process each site was considered on its own merits and the fact that a site is identified as a

proposed site does not necessarily mean that it is free from constraints but rather that it is considered the most suitable, or least constrained site in a required location, compared to the alternatives considered. In a similar manner, the proposed drive strategy does not necessarily mean that it is free from constraints but rather that it is considered the most suitable, or least constrained, compared to the alternative drive strategies considered.

3.6.11 In this section and in Section 3.7, a brief summary of the conclusion reached by the Mayor of London at phase two consultation on the proposed site is given. The Mayor did not provide additional detailed comments on individual sites at the Section 48 stage.

Zone S0: Acton Storm Tanks

3.6.12 Acton Storm Tanks (S01EG/C01YC) is identified as the proposed CSO and main tunnel site at the western end of the main tunnel within Zone S0.

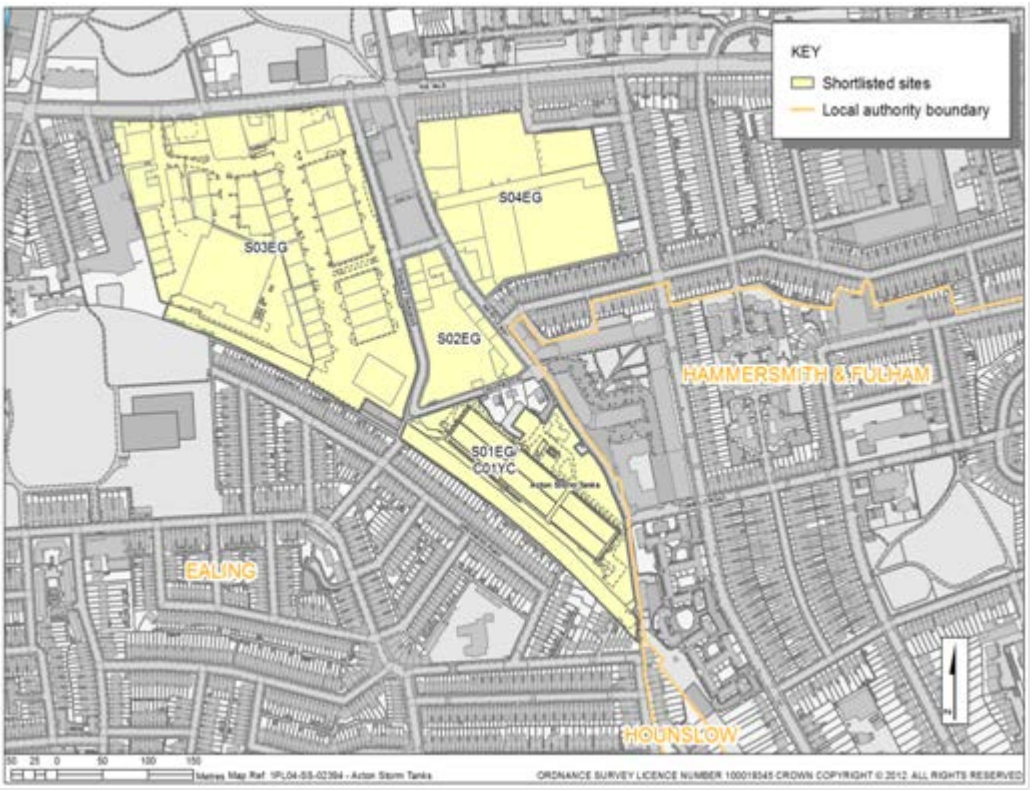
3.6.13 The three alternative sites considered were (see also Vol 1 Plate 3.6.2):

a. S02EG/C01YC: Commercial Units, Stanley Gardens

b. S03EG/C01YC: Acton Park Industrial Estate

c. S04EG/C01YC: Industrial Units, Allied Way.

Vol 1 Plate 3.6.2 Location of shortlisted main tunnel sites in Zone S0



3.6.14 In comparison to the alternatives, use of the Acton Storm Tanks site would only require this one site to intercept the CSO and support a main tunnel construction site. It would not result in the loss of existing businesses and is the only option which would maximise the use of an existing Thames Water operational site.

3.6.15 All of the alternative sites would require the use of two worksites, one to intercept the CSO and one to construct the shaft to receive the main tunnel. Of the alternatives, Commercial Units, Stanley Gardens (S02EG/C01YC) was not taken forward because it would require the demolition of a number of existing industrial units and the relocation of the associated businesses and could also impact on a place of worship and a resource/study centre.

3.6.16 The Acton Park Industrial Estate (S03EG/C01YC) would also require the demolition of a number of existing industrial units and the relocation of the associated businesses. The site is also within or in close proximity to a number of planning and environmental policy designated areas and sensitive uses such as residential properties, community facilities and public open space. For these reasons the site was not taken forward.

3.6.17 The Industrial Units, Allied Way (S04EG/C01YC) is occupied by industrial units and a retail outlet which would need to be demolished and the businesses relocated. There are also residential properties and a music teaching facility in close proximity. The site is also at a greater distance from the site at which the CSO would be intercepted and would therefore require a longer connection tunnel to connect the CSO to the main tunnel. Construction of this tunnel would be complex and would need to be deeper than the chosen option, due to the existing structures between the two sites, increasing the amount of excavated material to be removed from the site and also lengthening the construction programme. For these reasons the site was not taken forward.

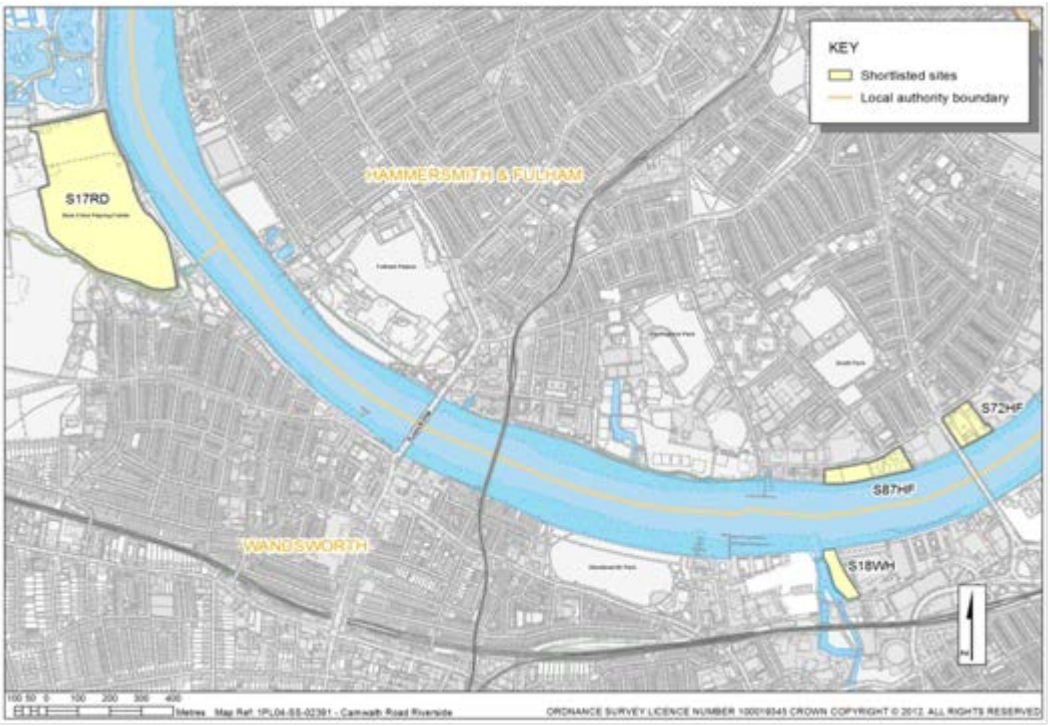
3.6.18 At phase two consultation the Mayor accepted that "the preferred option is the best option as it has the fewest impacts" although stated Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Zones S2 and S3: Carnwath Road Riverside

3.6.19 Carnwath Road Riverside (S87HF) is identified as the proposed main tunnel construction site at the western end of the main tunnel within zones S2 and S3.

3.6.20 The alternative to a main drive site in these zones was S17RD: Barn Elms (within zone 2). Two further sites (S72HF and S18WH) were shortlisted during the site selection process within these zones but were only large enough for main tunnel reception sites and are not regarded as alternatives to the use of Carnwath Road Riverside as a main drive site (Vol 1 Plate 3.6.3).

Vol 1 Plate 3.6.3 Shortlisted main tunnel sites in Zones S2 and S3



3.6.21 Carnwath Road Riverside was taken forward because, unlike the alternative site of Barn Elms, it is a brownfield site and would not result in the loss of undeveloped, public open space. Carnwath Road Riverside also includes an existing wharf with direct access to the river which would facilitate the export of excavated materials on the river. There is likely to be less conflict with recreational users of the River Thames than at Barn Elms where the river is busier and new jetty/wharf structures would need to be created in the river. The Carnwath Road Riverside site has better access to the public road network than the alternative and its use is likely to generate fewer significant environmental effects. It is however acknowledged that use of the Carnwath Road Riverside site would require the relocation of existing retail businesses and is within an area designated for residential-led regeneration.

3.6.22 The alternative site of Barn Elms has no existing wharves, unlike the proposed site, and its current use is predominantly recreational. The use of Barn Elms for a main tunnel construction site would also be likely to impact on nearby ecological sites including the London Wetland Centre Site of Special Scientific Interest and the River Thames and Beverley Brook Sites of Importance for Nature Conservation. For these reasons the site was not taken forward.

3.6.23 At phase two consultation, the Mayor supported the switch to Carnwath Road Riverside from Barn Elms (the proposed site in phase one consultation) as "this relocates major tunnelling activities from a Greenfield to a partially derelict Brownfield site" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Zone S5: Kirtling Street

3.6.24 Kirtling Street with Cringle Street (S72WH/S93WH) is identified as the main tunnel construction site within zone S5.

3.6.25 The alternative sites considered within this zone were (see also Vol 1 Plate 3.6.4):

a. S61WH: Battersea Park

b. S68WH: Battersea Power Station

c. S86WH/S80WH: Post Office, Nine Elms Lane

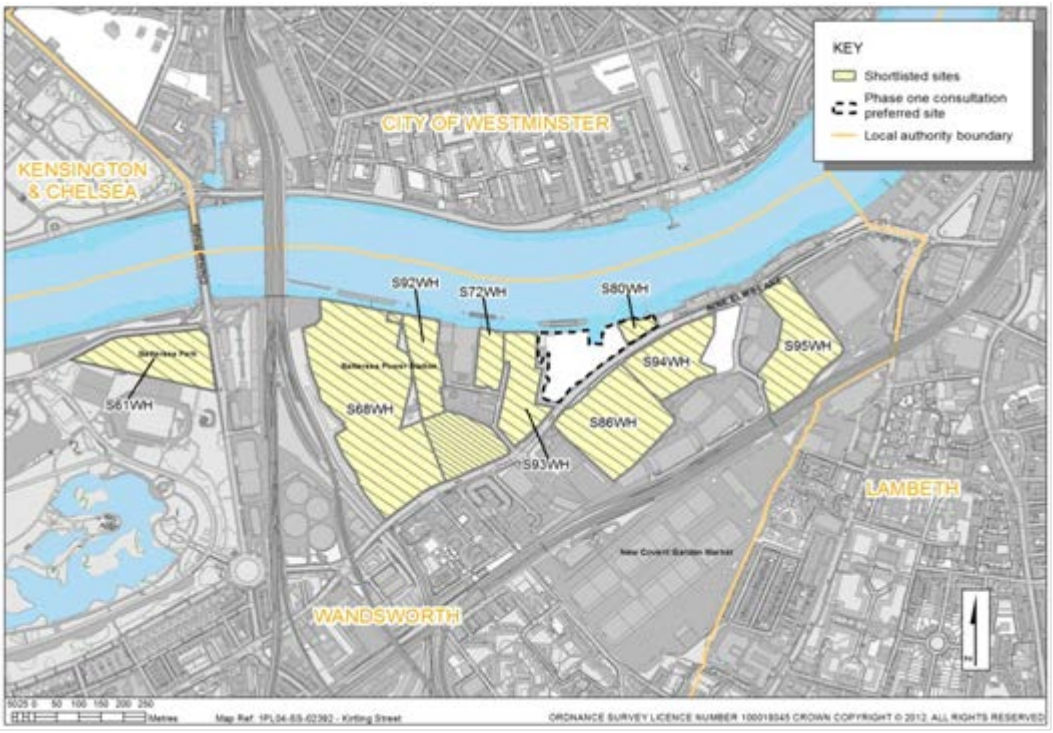
d. S92WH: Part of Battersea Power Station

e. S93WH: Kirtling Street

f. S94WH/S80WH: Post Office Way

g. S95WH: Depots, Ponton Road.

Vol 1 Plate 3.6.4 Shortlisted main tunnel sites in Zone S5



3.6.26 Kirtling Street with Cringle Street was taken forward because it is in a predominantly industrial area where large-scale redevelopment is proposed and is more capable than the alternative sites of accommodating a main tunnel construction site with river access. Part of the proposed site forms part of the proposed Battersea Power Station redevelopment area. This part of the site is however scheduled for later development phases and so offers the potential for complementary timescales for construction.

3.6.27 Of the alternative sites considered within this zone, Battersea Park is a Greenfield site and a Grade II* Registered Park and Garden. The site was not taken forward because it would result in the substantial although temporary loss of public open space and would potentially affect heritage features, landscape, townscape and archaeology.

3.6.28 Battersea Power Station was not taken forward because it would affect the setting of the Grade II* listed power station and the location of the shaft would be constrained by existing service and utility tunnels. There are also approved proposals for the redevelopment of the site which would conflict with the use of the area as a construction site and significantly increase the acquisition risk and costs.

3.6.29 The combined site which comprises the Post Office, Nine Elms Lane is located further from the river than the other sites and the construction of jetty facilities in the vicinity of the site would be difficult. Furthermore, excavated material would have to be transported across Nine Elms Lane to reach the riverbank. The alignment of the main tunnel would need to be brought inland causing it to run underneath a number of buildings, some of which are likely to have deep piled foundations. For these reasons the site was not taken forward.

3.6.30 Part of Battersea Power Station (S92WH) site contains the Grade II listed power station building noted above and also a district heating plant which would need to be relocated. The shape of the site is constrained and there are approved proposals for the redevelopment of the site which conflict with any potential use as a construction site and significantly increase the acquisition risk and costs. For these reasons the site was not taken forward.

3.6.31 Kirtling Street (S93WH) on its own was not taken forward because it has less river frontage than the proposed site and therefore it would be more difficult to construct and operate the jetties which are required to make effective use of the river to transport construction materials. It is also not large enough to support a double drive site on its own. For these reasons the site was not taken forward on its own.

3.6.32 The combined site on Post Office Way was not taken forward because it was anticipated that the site would be contaminated and would also contain a number of underground structures which would make engineering work more complex due to its previous use as part of the Nine Elms Gas Works. As with the combined Post Office, Nine Elms Lane site, the Post Office Way site is located away from the river, so excavated material would have to be transported across Nine Elms Lane to reach the riverbank. The alignment of the main tunnel would need to be brought inland causing it to run underneath a number of buildings, some of which are likely to have deep piled foundations.

3.6.33 The Depots, Ponton Road site is also situated further from the river than some of the other alternative sites and so would also require excavated materials to be transported across Nine Elms Lane. Use of the site would also be likely to have a greater impact on residential properties at Elm Quay Court and Riverside Court than the proposed site and some of the other alternatives. For these reasons the site was not taken forward.

3.6.34 At phase two consultation, the Mayor stated that he was "not yet convinced that this site is the best site to be used" and recommended that "further exploration of the potential of using land in and around Battersea Power Station" was required. However, if the Battersea Power Station

area is not feasible and Thames Water resolved a number of concerns, the Mayor stated that "the Kirtling Street site may be acceptable".

Zones S6 and S7: Chambers Wharf

3.6.35 Chambers Wharf is identified as the proposed main tunnel site within Zones S6 and S7.

3.6.36 The alternatives considered in these zones were:

a. S54SK: King's Stairs Gardens

b. S76SK: Chambers Wharf

c. S020T: Shadwell Basin

d. S021T: King Edward Memorial Park

e. S024T and S025T: Heckford Street

f. S036T: Limehouse Basin.

3.6.37 Chambers Wharf was taken forward as it is a brownfield site and has direct river access. The site is also closer than the alternatives to the predicted position of the change in geology from clay and gravel to chalk, and therefore is closer to the point where different tunnelling machines would be used. Nevertheless, it is acknowledged that the use of the site would likely impact on residential properties adjacent to and overlooking the site, and local schools and that mitigation would be required.

3.6.38 Although it has been considered suitable at an earlier stage, King's Stairs Gardens (S54SK) was not taken forward because it would result in the temporary loss of an area of public open space which is designated as a Site of Importance for Nature Conservation (SINC), Metropolitan Open Land (MOL) and lies within a conservation area. In addition, the site is surrounded by sensitive receptors, including residential dwellings, church, convent and a community centre which includes a nursery and college.

3.6.39 Shadwell Basin is located at a distance from the river and significant preparatory works would be needed to construct the shaft and there would be considerable difficulties moving barges to and within the site. There are also a large number of environmental and community considerations related to the use of this site. The site is surrounded by residential property and appears likely to impact on the Shadwell Outdoor Activity Centre. For these reasons the site was not taken forward.

3.6.40 The use of King Edward Memorial Park for a main tunnel site and would result in a temporary loss of an extensive area of public open space. Unlike the use of the foreshore for CSO interception, use for a main tunnel site would leave little amenity space within a zone that is considered to have few nearby alternatives. For these reasons the site was not taken forward as a main tunnel site.

3.6.41 The use of the combined site at Heckford Street as a main tunnel site would require the demolition of warehouses leading to the loss of employment facilities and the need to relocate existing businesses. In addition as the site is not on the river it would not support a main tunnel drive site. Its use as a main tunnel reception site would require the main

tunnel to be diverted inland under a number of existing properties. For these reasons the site was not taken forward as a main tunnel site.

3.6.42 Limehouse Basin has relatively poor vehicular access and the site would require extensive enabling and reinstatement works prior to and following construction. A neighbouring building may need to be demolished to create sufficient access to the site. There are also a large number of environmental and community constraints at this site. The site is surrounded by residential properties and its use would have significant impacts on the basin's use as a marina. For these reasons the site was not taken forward.

3.6.43 At phase two consultation, the Mayor accepted "the selection of Chambers Wharf...in principle" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Zone S11: Abbey Mills Pumping Station

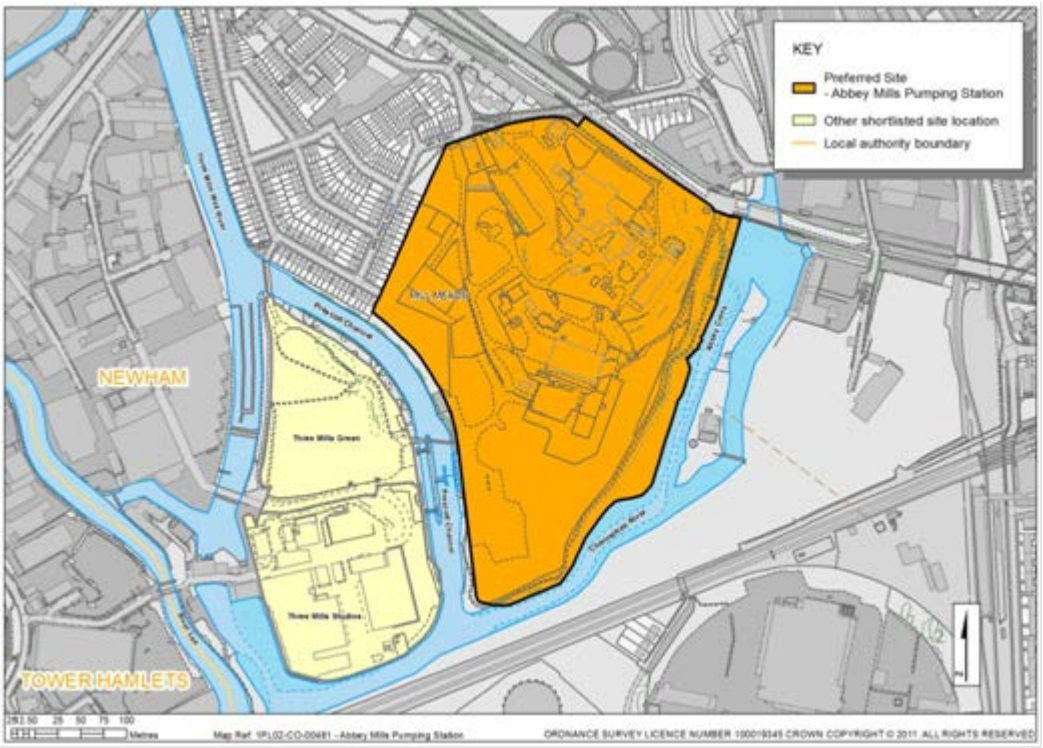
3.6.44 Abbey Mills Pumping Station is identified as the proposed main tunnel site at the eastern end of the main tunnel.

3.6.45 The alternatives considered in this zone were (see also Vol 1 Plate 3.6.5):

a. S85NM: Three Mills Green

b. S86NM: Three Mills Studio.

Vol 1 Plate 3.6.5 Shortlisted main tunnel sites in Zone S11



3.6.46 In comparison to the alternatives, Abbey Mills Pumping Station was taken forward because the proposed site includes the area surrounding Lee Tunnel shaft F (under construction), to which the Thames Tideway Tunnel would need to be connected. If another site was chosen within this zone,

there would still be a need to have a construction site at Abbey Mills to join that other site to shaft F. Abbey Mills Pumping Station is an operational Thames Water site and the southern part of the site is currently a construction site, being used to build Lee Tunnel shaft F.

3.6.47 Three Mills Green was not taken forward because it would be technically difficult to connect the shaft to Lee Tunnel shaft F with a connection tunnel under Prescott Channel. Use of the site would also lead to the temporary loss of open space and would impact on residential and business properties in the vicinity. For these reasons the site was not taken forward.

3.6.48 The Three Mills Studio site is similar to Three Mills Green in being west of the Prescott Channel and would be technically difficult to connect the shaft to Lee Tunnel shaft F with a connection tunnel. The site would also require the demolition of existing buildings on site and the relocation of businesses currently operating out of the Three Mills Studio site. Use of the site would also impact on Three Mills Green, an area of open space. For these reasons the site was not taken forward.

3.6.49 At phase two consultation, the Mayor accepted that "the preferred option is acceptable" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Drive strategy

3.6.50 Based on the above conclusions on main tunnel sites as well as consideration of the relative merits and demerits of each drive direction, the preferred drive option for connecting the main tunnel sites was identified as follows:

a. main drive from Carnworth Road Riverside to Acton Storm Tanks.

b. main drive from Kirtling Street to Carnworth Road Riverside

c. main drive from Kirtling Street to Chamber Wharf

d. main drive from Chambers Wharf to Abbey Mills

e. long connection tunnel drive from Greenwich Pumping Station to Chambers Wharf

f. connection tunnel drive from Dormay Street north to Carnworth Road Riverside and south to King George's Park.

3.6.51 Kirtling Street was chosen as a main double drive site in the central part of the route because the site has direct river access with potential to allow use of barges to remove material during construction and has good access from Nine Elms Lane (A3025). Compared to alternative drive strategies, which could include using the site as a single drive site, use of this site as a double drive site allows the project to have a greater focus of works in a predominantly industrial area which has already been earmarked for significant re-development. This then means that less construction work would be required at sites which are judged to be more constrained.

3.6.52 Carnwath Road Riverside was chosen as a main drive site in the west because the site is on the river, has an existing wharf and would therefore allow use of barges to remove excavated material. The alternative of driving from Acton to Carnwath Road Riverside was eliminated given that Acton is remote from the river and so use as a drive site would not enable export of excavated material by barge.

3.6.53 Chambers Wharf was chosen as a main drive site in the eastern part of the route because, as with other proposed main tunnel drive sites, the site has direct river access to enable the use of barges to remove excavated material during construction. At Abbey Mills, the River Lee would not allow a reliable barge operation for the export of large volumes of this material and so this site is considered to be highly undesirable as a drive site. It follows that the long connection tunnel to Greenwich Pumping Station must be driven from Greenwich Pumping Station to Chambers Wharf as there is insufficient space at Chambers Wharf to support a double drive site.

3.6.54 Longer drive options which bypass main tunnel sites have been considered but are not considered viable. In the east the alternative of driving from Kirtling Street directly to Abbey Mills (so avoiding Chambers Wharf) was considered but at 13km this would exceed the maximum drive length and the change in geology from the Lambeth Group to Chalk requires two TBMs to be used. In the west a drive from Kirtling Street directly to Acton (so avoiding Carnwath Road Riverside) was considered but this drive would exceed the available programme and without an appropriate shaft would not enable a required step in the tunnel which is required to avoid the London Ring Main.

3.7 CSO sites

3.7.1 CSO sites must be located close to the existing CSOs, which vary in size and location. Each CSO site must accommodate the permanent structures required for the operation of the system (the interception of the CSOs) and, on a temporary basis, the construction plant and methods required to create the CSO interception. Each site would be required for construction purposes for approximately one to four years, and will be between 1,500m^2 and 7,500m^2 in size, depending on the construction and operational requirements.

3.7.2 In some cases it has been possible to combine main tunnel construction sites with CSO sites and so reduce the overall number of sites and deep shafts required by the project.

3.7.3 This section provides an overview of the interception requirements at each CSO and provides a short summary of the reasons for the selection of the proposed CSO site. At each CSO, the other short-listed alternative sites are identified and the main reasons why they were not selected are given. Other sites which did not progress beyond the long list in each location are not reviewed since they do not generally represent viable alternatives.

3.7.4 During site selection, each site was considered on its own merits. Where a site forms part of the project for which development consent is sought,

this does not necessarily mean that it is free from constraints, but rather that it is considered the most suitable, or least constrained, site in a required location compared to the alternatives considered.

Acton Storm Tanks

3.7.5 There is need to intercept the Acton Storm Relief sewer at or in the vicinity of the Acton Storm Tanks. However this interception has been combined with the need for a main tunnel construction site at this site and is covered at paragraph 3.6.12 above.

Hammersmith Pumping Station

3.7.6 Hammersmith Pumping Station (C04XN) is identified as the proposed site to intercept Hammersmith Pumping Station CSO and connect it to the main tunnel.

3.7.7 The alternative sites considered were:

a. C04XA: Foreshore, adjacent to Chancellors Wharf

b. C04XG: Frank Banfield Park

c. C04XJ/C04XF: Adjacent to Hammersmith Pumping Station

d. C04XP: TW Depot and Pumping Station, Chancellors Road.

3.7.8 In comparison to the alternatives, there would be no significant technical challenges in using Hammersmith Pumping Station and there would be a reduced risk of conflicts with other utilities. The site is immediately adjacent to an existing Thames Water operational site and benefits from the screening effect of the existing pumping station. The shaft is also located further from existing residential dwellings than the alternative sites. It is considered the most suitable site in the required location.

3.7.9 Of the alternatives, the foreshore adjacent to Chancellors Wharf, was not taken forward because it has poor access. There would also be impacts on residential properties and the users of the Thames Path. In general, foreshore sites have been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats.

3.7.10 Frank Banfield Park was not taken forward because the site is subject to several policy designations and is located within a conservation area. Furthermore, use of the site would result in the temporary loss of public open space and impact on nearby residential dwellings.

3.7.11 The site Adjacent to Hammersmith Pumping Station is situated more than 200m from the river and would therefore require more tunnelling that the proposed site. The site is subject to several planning and environmental policy designations. For these reasons the site was not taken forward.

3.7.12 The Thames Water Depot and Pumping Station site on Chancellors Road was not taken forward because the construction works on the depot part of the site in particular would be in close proximity to existing critical main sewers and existing residential and light industrial buildings.

3.7.13 At phase two consultation, the Mayor accepted "that the preferred option is the best option as it has the fewest impacts" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Barn Elms

3.7.14 Barn Elms (C05XQ) is identified as the proposed site to intercept the West Putney CSO and connect it to the main tunnel.

3.7.15 The alternatives considered were:

a. C05XA: Foreshore, adjacent to Barn Elms

b. C05XD: Boat repair yard, off Putney Embankment

c. C05XE: Leaders Gardens, Putney Embankment.

3.7.16 The use of Barn Elms, in contrast to the alternatives, would allow all works for the drop shaft and interception chamber construction to be carried out within one site. The site would be well separated from Leaders Gardens and adjacent residential properties which would protect residential amenity to a greater degree than the other site options. The use of the site would not result in the loss or relocation of land for employment use unlike the alternative sites. The use of the site would however result in the loss of open space within an area designated as Metropolitan Open Land although the loss would only be temporary.

3.7.17 The foreshore, adjacent to Barn Elms was not taken forward because it would require interception works outside the CSO drop shaft site area and in close proximity to the Beverley Brook flood barrier. Access to the site would be difficult and the site would be in close proximity to a high pressure gas main. Users of the Thames Path, Sea Cadet premises and scout hut would experience more disruption than with the proposed location. In general, foreshore sites have been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats.

3.7.18 The Boat Repair site, off Putney Embankment was not taken forward because the interception chamber and connecting culvert would be outside the site boundary. The use of the site would require the relocation of the boat repair business and demolition of the Sea Cadet building and there would be noise disturbance to the adjacent Leaders Gardens, the residential properties and the Barn Elms Schools sports centre opposite the site.

3.7.19 Leaders Gardens, Putney Embankment was not taken forward because the use of the site would result in the temporary loss of a park. The use of the site would be likely to have greater detrimental impacts on the local community, residents and other users than the proposed site.

3.7.20 At phase two consultation, the Mayor accepted that the works at Barn Elms "can be implemented acceptably" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Putney Embankment Foreshore

3.7.21 Putney Embankment Foreshore (C06XK) is identified as the proposed site to intercept the Putney Bridge CSO and connect it to the main tunnel.

3.7.22 The alternative sites considered were:

a. C06XL: Lower Richmond Road Foreshore

b. C06XM: Putney Wharf Foreshore.

3.7.23 Putney Embankment Foreshore would be less likely to affect nearby residential properties and other sensitive receptors than the alternative sites. It is located further from the Grade II listed Putney Bridge than the alternatives, and would potentially avoid having a direct impact on the historic slipway.

3.7.24 The greater separation between the Putney Embankment Foreshore and the Putney Bridge CSO would require a longer connection culvert than the Lower Richmond Road Foreshore site, however the benefit of a reduced impact on the setting of the Grade II listed Putney Bridge and on nearby residential properties outweigh the disadvantages associated with the greater tunnelling length required.

3.7.25 The Lower Richmond Road Foreshore site is immediately adjacent to a historic slipway which would need to be incorporated within the worksite. Given that a shaft is required in this area, the need to retain the slipway in situ, as well as the immediate proximity of Putney Bridge makes this location problematic. For these reasons the site was not taken forward for the shaft location.

3.7.26 The alternative Putney Wharf Foreshore was not taken forward as it would have adverse effects on multiple sensitive receptors including St Mary's Church (Grade II* listed building), Putney Wharf Tower and the nearby Boathouse public house. Vehicle access to the site is poor.

3.7.27 At phase two consultation, the Mayor considered that "the preferred option is acceptable" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was suitable.

Dormay Street

3.7.28 Dormay Street (C07AR/CL008) is identified as the proposed site to intercept the Frogmore Storm Relief - Bell Lane Creek CSO and connect it to the main tunnel.

3.7.29 The alternative sites considered were:

a. C07AB: London Borough of Wandsworth Maintenance Depot, Dormay Street

b. C07AF: Bell Lane Creek.

3.7.30 In comparison to the alternative sites, the use of the Dormay Street site would have less impact on local businesses and employment and would result in less disruption to council activities and operation. Heavy good vehicles would use a temporary bridge over Bell Lane Creek and this

would minimise vehicle movement along the Causeway and would ensure that the majority of vehicle movements would remain within the site.

3.7.31 The use of the London Borough of Wandsworth Maintenance Depot site would lead to the displacement of the council's maintenance depot and it would be difficult to find an alternative location for this facility. The site is within an established employment area and it would lead to a loss of existing employment uses. For these reasons the site was not taken forward.

3.7.32 Bell Lane Creek was not taken forward as it would require the demolition of an existing two storey building and would affect the businesses located on site. A residential dwelling to the west of the site on Frogmore would also experience disruption.

3.7.33 At phase two consultation, the Mayor stated that “The proposed site is supported provided that suitable arrangements are in place with LB Wandsworth to manage the impacts on the LB W Depot.” and identified several concerns which would need to be addressed to ensure that the use of this site was acceptable.

King George's Park

3.7.34 King George's Park (C07BF) is identified as the proposed site to intercept the Frogmore Storm Relief - Buckhold Road CSO and connect it to the main tunnel.

3.7.35 The alternative site considered was C07BD: Parking to rear of properties fronting Buckhold Road.

3.7.36 In comparison to the alternative site, King George's Park would not impact on Wandsworth Town Conservation Area, avoid the need for significant works in Broomhill Road and Buckhold Road and would not involve the loss of car parking in the area. The site and the proposed location of the drop shaft are further away from residential properties in comparison to the alternative site. The site would have good access during the construction and operational phases, and all works would be contained within the site. Although the use of King George's Park would mean the temporary loss of a section of the park, the majority of the park would remain in use.

3.7.37 The alternative site would have a more direct impact than the proposed site on the residential amenity of the flats which would be in very close proximity and on the adjacent Wandsworth Town Conservation Area. The use of the site would result in the loss of car parking for the adjacent residential flats and it would be difficult to provide alternative parking facilities within the locality. The site would require the construction of an interception chamber at the junction of Broomhill Road and Buckhold Road, as well as a connection culvert. This work would cause significant disruption to the local road network and the community as deep and disruptive excavations would be required along the residential road. For these reasons the site was not taken forward.

3.7.38 At phase two consultation, the Mayor considered that "the preferred option is acceptable" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Falconbrook Pumping Station

3.7.39 Falconbrook Pumping Station (C09XH) is identified as the proposed site to intercept the Falconbrook Pumping Station CSO and connect it to the main tunnel.

3.7.40 The alternative sites considered were:

a. C09XA: Foreshore, near London Heliport, Lombard Road

b. C09XC: Bridges Court Car Park

c. C09XD: York Gardens, adjacent to York Road

d. C09XE: York Gardens, adjacent to Pennethorne House.

3.7.41 The use of the Falconbrook Pumping Station site is likely to have less impact on residential amenity compared to the alternative sites. The use of the site would also provide the opportunity to consolidate all permanent structures and control facilities within an operational Thames Water compound and/or the curtilage of Thames Water land. This would also minimise the impact on the public and third parties during maintenance periods. The proposed site is the most technically challenging of the options however this is outweighed by the reduced impacts on the local community in comparison to the alternative sites.

3.7.42 Bridges Court Car Park was not taken forward because the site is allocated for mixed use development and has been the subject of several recent planning applications. Even if the site was still available at the time of construction, the use of the site would impact on a large number of residential properties in close proximity to the site. For these reasons the site was not taken forward.

3.7.43 The alternative site of the foreshore, near London Heliport, is located within the River Thames foreshore which is designated as a site of Metropolitan Importance for Nature Conservation. In general foreshore sites have been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats. In addition, this site has poor vehicular access and would only be suitable for light vehicles and pedestrians. For these reasons the site was not taken forward.

3.7.44 York Gardens, adjacent to York Road is a Greenfield site. The use of the site would result in the loss of open space and would require the clearance of mature trees subsequently affecting the screening for the children's centre from York Road. For these reasons the site was not taken forward.

3.7.45 York Gardens, adjacent to Pennethorne House is a Greenfield site and the use of this site would result in the loss of protected open space. Construction traffic would be required to utilise the access road currently used by the children's adventure playground, which would increase the

health and safety risk to the public. For these reasons the site was not taken forward.

3.7.46 At phase two consultation, the Mayor considered that "the preferred option is the best option as it has fewer impacts than the Phase 1 proposal" (which was to use the Bridges Court Car Park site) although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Cremorne Wharf Depot

3.7.47 Cremorne Wharf Depot (C10XB) is identified as the proposed site to intercept the Lots Road Pumping Station CSO and connect it to the main tunnel.

3.7.48 The alternative site considered was C10XA: Cremorne Wharf Foreshore.

3.7.49 The use of the Cremorne Wharf Depot site means it can be accessed from Lots Road using existing access points on either side of the pumping station and therefore avoids the need to create an access road across Cremorne Wharf which was a main concern identified with the alternative site. The use of this site would have significantly fewer effects on the river and aquatic ecology, townscape and river views and the setting of the Thames Conservation Area. It would be preferable from a cost and health and safety point of view than the alternative site.

3.7.50 The alternative of the Cremorne Wharf Foreshore site (C10XA) would not have direct road access and as stated above would require new access to be constructed along the foreshore. There would also be more substantive impacts on residential amenity associated with this new access. Furthermore, as noted above, foreshore sites have generally been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats. For these reasons the site was not taken forward.

3.7.51 At phase two consultation the Mayor stated that "the changes to the site and access arrangements of the site are supported" however added that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Chelsea Embankment Foreshore

3.7.52 Chelsea Embankment Foreshore (opposite Bull Ring Gate) (C14XJ/CLLAH) is identified as the proposed site to intercept Ranelagh CSO and the northern Low Level Sewer and to connect them both to the main tunnel.

3.7.53 The alternative sites considered were:

a. C14XA/CLLAA: Chelsea Embankment Foreshore (west of Chelsea Bridge)

b. C14XH/CLLAG: Ranelagh Gardens.

3.7.54 In comparison to the alternative sites, Chelsea Embankment Foreshore (opposite Bull Ring Gate) would allow a shorter connection tunnel, which would result in fewer health and safety risks associated with constructing a connection tunnel in the Lambeth Group. It would have less direct impact on the Grade II registered Ranelagh Gardens and would only require a single structure in the river.

3.7.55 While the use of the site would result in the loss of some foreshore habitat and give rise to potential effects on subsurface archaeology, the foreshore location would allow for use of the river for export of excavated materials, which would reduce the potential effects of traffic.

3.7.56 The use of the Chelsea Embankment Foreshore (west of Chelsea Bridge) site would require two structures in the river, one at the outfall of the existing CSO and one at the drop shaft and would not offer the same opportunity as the proposed site to provide a meaningful open space connection to the adjacent surroundings. The use of this site would also have greater effects on the setting of the Grade II listed Chelsea Bridge. For these reasons the site was not taken forward.

3.7.57 The alternative site of Ranelagh Gardens was not taken forward as it would have a greater detrimental impact on residential amenity and the Grade II listed Ranelagh Gardens than either of the foreshore sites. The use of Ranelagh Gardens as a construction site would significantly affect the use of the gardens by local residents and would be highly disruptive to major events that are held there.

3.7.58 At phase two consultation, the Mayor was "not yet convinced that the preferred site is the optimal one" and identified a number of concerns that Thames Water would need to address to ensure that the site was acceptable with particular focus given to the need for traffic modelling.

Heathwall Pumping Station

3.7.59 Heathwall Pumping Station (C16XB) is identified as the proposed site to intercept the Heathwall Pumping Station and South West Storm Relief CSOs, and connect them to the main tunnel.

3.7.60 The alternative site considered was C16XA: Foreshore (adjacent to Heathwall Pumping Station and Middle Wharf).

3.7.61 Heathwall Pumping Station was taken forward as the proposed site as it maximises the use of Thames Water's existing site and minimises the impact of permanent works in the foreshore.

3.7.62 The alternative site, on the Foreshore, was not taken forward as it lies entirely in the foreshore of the River Thames. In general foreshore sites have been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats. The site would also impact on the houseboats (Tideway Dock and Nine Elms Pier) and restaurant (the Battersea Barge) adjacent to the site.

3.7.63 At phase two consultation, the Mayor considered that "the current site is broadly acceptable" although stated that Thames Water would need to

address a number of concerns to ensure that the use of this site was acceptable.

Albert Embankment Foreshore

3.7.64 The foreshore, adjacent to offices, Albert Embankment (C20XS) is identified as the proposed site to intercept the Clapham Storm Relief and Brixton Storm Relief CSOs and to connect these CSOs to the main tunnel.

3.7.65 The alternative sites considered were:

a. C19XA: Foreshore, adjacent to St George Wharf and Vauxhall Bridge

b. C20XA: Foreshore, adjacent to SIS Building and Vauxhall Bridge

c. C20XH: Open Space, Claylands Road.

3.7.66 The proposed site would have the least impact on the setting of the Grade II* listed Vauxhall Bridge and on fluvial flows. The use of this site unlike the alternative site, Foreshore adjacent to SIS Building and Vauxhall Bridge, segregates access from Duck Tours' slipway access thereby enabling Duck Tours to continue to operate.

3.7.67 The alternative site, Foreshore, adjacent to St George Wharf and Vauxhall Bridge, was not taken forward because the site does not have any viable land-based access. The London Underground Victoria Line tunnels run under the site, which meant that the deep CSO drop shaft would need to be built at the south of the site where a new passenger service pier is located.

3.7.68 The alternative site, Foreshore, adjacent to SIS Building and Vauxhall Bridge was not taken forward as it has a number of distinct disadvantages when compared to the proposed site. Use of the site would also require a much larger structure to be created in the river to accommodate both the works to intercept the CSO and the shaft to connect the CSO to the main tunnel. This structure would be in close proximity to the Grade II* listed Vauxhall Bridge, therefore have a greater impact on its setting than the proposed site. The larger structure would also have a greater impact on river flow, scour and the authorised (navigation) channel. It is also probable that construction access to the site would close Lack's Dock, which would not be the case with the proposed site.

3.7.69 The third alternative listed of the Open Space, Clayland Road is relatively remote from the river and as a result the interception of the sewers would be difficult. The site would only allow the interception of the Brixton Storm Relief CSO and therefore it could only have been a possible partial solution in conjunction with a foreshore site required to intercept the Clapham Storm Relief CSO. For these reasons, the site was not taken forward.

3.7.70 At phase two consultation, the Mayor considered that "the preferred option is acceptable" providing Thames Water addressed a number of concerns.

Victoria Embankment Foreshore

3.7.71 Victoria Embankment Foreshore (C22XA/CLLAC) is identified as the proposed site to intercept the Regent Street CSO and the Low Level No.1 sewer, and connect them to the main tunnel.

3.7.72 The alternative site considered was C22XC/CLLAD: Victoria Embankment Gardens.

3.7.73 The Victoria Embankment Foreshore site was taken forward because it would allow all works to be located within one site and would only require a short connection tunnel compared to the alternative. It is also further away from Whitehall Court and the Liberal Club than the alternative, which would minimise the effect on the setting and the potential construction effects such as noise and dust on local residents.

3.7.74 The use of the alternative site at Victoria Embankment Gardens would have more significant heritage and community effects. In addition to the use of the gardens, a second site on the foreshore or the closure of at least two lanes of Victoria Embankment would also be required during construction. The Gardens are also closer to the District and Circle Underground Lines. For these reasons, the site was not taken forward.

3.7.75 At phase two consultation, the Mayor stated that "there does not appear to be any realistic alternative" to the proposed option however added that "Thames Water will need to undertake further work to ensure that the site can be delivered in an acceptable way".

Blackfriars Bridge Foreshore

3.7.76 Blackfriars Bridge Foreshore (C27XA/CLLAE) is identified as the proposed site to intercept the Fleet Main CSO and the Low Level Sewer No. 1, and connect it to the main tunnel.

3.7.77 Blackfriars Bridge Foreshore was the only shortlisted site for the interception of this CSO due to the constrained urban nature of the area around the Fleet Main CSO which includes extensive structures, transport and utility corridors. There are no suitable alternative sites to intercept this major CSO. There are substantial engineering challenges due to the constrained location of the site and the large flows that would need to be diverted to the tunnel although this has been addressed through careful design which has also needed to consider navigational and fluvial issues.

3.7.78 At phase two consultation, the Mayor considered that "there does not appear to be any realistic alternative" to the proposed option although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

King Edward Memorial Park Foreshore

3.7.79 King Edward Memorial Park Foreshore (C29XA) is identified as the proposed site to intercept the North East Storm Relief CSO and connect it to the main tunnel.

3.7.80 The alternatives considered were C29XB: King Edward Memorial Park in combination with one of three other sites, which would be required to connect the CSO to the main tunnel:

a. S024T with S025T: Heckford Street

b. S020T: Shadwell Basin

c. S036T: Limehouse Basin.

3.7.81 The use of the proposed site, King Edward Memorial Park Foreshore, would require less of the existing park to intercept the CSO and connect it to the main tunnel than the alternatives. The proposed site would involve constructing temporary and permanent cofferdams on the river foreshore and would result in the temporary loss of some sport and recreational facilities in the park and a small part of public open space.

3.7.82 The use of the King Edward Memorial Park (C29XB), along with one of the three additional sites, would involve the temporary loss of a larger area of public open space within the park and would be likely to cause greater disruption to users of the park.

3.7.83 The alternatives which relied on Shadwell Basin and Limehouse Basin were not considered viable alternatives because it would be technically challenging to undertake the construction works within water basins, both sites have poor access and they are further away from the CSO. This means a longer connection tunnel would be required from one of these sites to the CSO in King Edward Memorial Park. Both basins are also surrounded and overlooked by residential properties. For these reasons these two alternatives were not taken forward.

3.7.84 The hydraulic and air quality management requirements for the alternative of the combined King Edward Memorial Park and Heckford Street site would require the construction of an additional relatively shallow connection tunnel to connect the CSO intercepted within the park to the main tunnel. These works would be more complex and have increased health and safety risks compared to the proposed single site approach. There would also be no option to use the river to transport excavated materials leading to greater road transport requirements for this alternative. For these reasons the combined alternative including Heckford Street was not taken forward.

3.7.85 At phase two consultation the Mayor stated that "the preferred option is considered the most appropriate" however further added that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Earl Pumping Station

3.7.86 Earl Pumping Station (C31XY/C31XZ) is identified as the proposed site to intercept the Earl Pumping Station CSO and connect it to the main tunnel.

3.7.87 The alternative sites considered were:

a. C31XA: Foreshore (adjacent to boat yard and St. George's Square)

b. C31XB: St George's Square

c. C31XC: Boat yard, Calypso Way

d. C31XK: Car Park, corner of Grove Street and Plough Way.

3.7.88 Earl Pumping Station is the only site that would contain the CSO interception works and CSO drop shaft works in one area. It would allow the CSO to be intercepted upstream of the pumping station, which would maximise the volume of flow intercepted and minimise pumping costs for the storm pumping station. The existing industrial setting of the site was considered more appropriate than the alternative shortlisted sites. It would also enable the operational infrastructure to be consolidated on one site and make use of (in part) of an existing Thames Water site. It is acknowledged that the use of the site would require the demolition of several commercial buildings and would impact on adjacent residences.

3.7.89 The use of the alternative site on the Foreshore (C31XA), was not taken forward as it would likely to the lead to the loss of a viewing area that extends into the river and would impact on the users of the adjacent Thames Path and residential properties in Deptford Wharf. Furthermore, foreshore sites have generally been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats.

3.7.90 The use of St George's Square (C31XB) would require the interception works to be located outside the main working area. The use of the site would impact on residential amenity to the south and west of the site and on parking and seating in St George's Square. For these reasons it was not taken forward.

3.7.91 The use of the Boat yard off Calypso Way (C31XC) site would impact on the operation of the boatyard and would also impact upon local residents and thereby was not taken forward. The relocation of the boat yard business that operates from the site was judged more problematic than the relocation of the businesses that occupy part of the proposed Earl Pumping Station site.

3.7.92 The use of the Car Park on the corner of Grove Street and Plough Way (C31XK), was not taken forward because, as with St George's Square, the interception works would be located outside the main working area and the provision for, or payment for, alternative parking facilities would be necessary during the project.

3.7.93 At phase two consultation, the Mayor commented that "the preferred option appears to be acceptable" although stated that Thames Water would need to address a number of concerns to ensure that the use of this site was acceptable.

Deptford Church Street

3.7.94 Deptford Church Street (C32XZ) is identified as the proposed site to intercept Deptford Storm Relief CSO and connect it to the main tunnel.

3.7.95 The alternative sites considered were:

a. C32XA: Borthwick Wharf Foreshore

b. C32XL: Land Adjacent to Bronze Street.

3.7.96 Deptford Church Street was taken forward in part because it has much better access for construction vehicles than the Borthwick Wharf Foreshore site and is close to the existing CSO. In addition it would avoid work in the foreshore and once operational the reinstated site would retain the existing nature and character of the area with the opportunity to enhance the quality of the open space. Unlike the alternatives, there are relatively few residential properties in the immediate vicinity of the site. It is however recognised that during construction the use of the site would impact on nearby sensitive receptors and the transport network and would result in the temporary loss of open space.

3.7.97 The alternative site of Borthwick Wharf Foreshore has substantially worse access than the proposed site and would inevitably disrupt the immediately adjacent AHOY centre yacht club and the groups that use it as it requires direct access to the river for its activities. Furthermore, foreshore sites have generally been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats.

3.7.98 The alternative site of Land adjacent to Bronze Street (C32XL) was not taken forward because it would lead to the loss of open space which is also designated as a Site of Importance for Nature Conservation. It would also impact on a conservation area, the Grade I listed St Paul's Church and residential properties. The closure of Deptford Church Street would also be necessary.

3.7.99 At phase two consultation the Mayor accepted that "the preferred option is preferable to the alternatives" however added that there are "significant concerns about the site and Thames Water will need to undertake further work to ensure that the site can be delivered in an acceptable way".

Greenwich Pumping Station

3.7.100 Greenwich Pumping Station with Phoenix Wharf (C33XV + CL005) is the proposed site to intercept the Greenwich Pumping Station CSO and to drive the Greenwich connection tunnel to Chambers Wharf.

3.7.101 The identification of a preferred site to intercept the Greenwich Pumping Station CSO had to take into account how the intercepted CSO would be connected to the main tunnel and the requirement for a drive site for the connection tunnel in the area. Greenwich Pumping Station alone is not sufficiently large to support a drive site in its own right and so additional parcels of land (either adjacent to it or nearby) had to be identified to support the drive site. This requirement was dependant on the finalised drive strategy for the eastern section (see para. 3.6.50 to 3.6.54, above).

3.7.102 The alternatives to the proposed approach which were considered are:

a. C33XV + CL004: Greenwich Pumping Station + Greenwich Industrial Estate, Norman Road

b. C33XV + S74SK: Greenwich Pumping Station + The Boatyard, off Calypso Way

c. C33XV + S01LM: Greenwich Pumping Station + Convoys Wharf

3.7.103 The Greenwich Pumping Station + Phoenix Wharf site was taken forward because the works to both intercept the CSO and drive the connection tunnel can be accommodated on one contiguous area. It is acknowledged that two businesses operating on Phoenix Wharf would need to be relocated and those operating out of the surrounding properties could face some disruption.

3.7.104 The alternative of using Greenwich Pumping Station with the Greenwich Industrial Estate was not taken forward because the use of the site would be contrary to the mixed-use designation and policies which are in place and construction work would be more likely to impact on residential and business properties than the proposed site.

3.7.105 The alternative of using Greenwich Pumping Station for the CSO interception in combination with the Boatyard to support the tunnel drive would be problematic as the boatyard is a small site and would need to be extended into the foreshore in order to create sufficient working space. Use of the site would result in the temporary loss of the boatyard for a lengthy period of time. In addition, foreshore sites have generally been avoided where other viable land-based sites are available for a number of reasons which include the increased health and safety risks; the increased construction costs associated with working in the river and the impacts to foreshore habitats. For these reasons the alternative was not taken forward.

3.7.106 The alternative of using Greenwich Pumping Station for the CSO interception with Convoys Wharf to support the tunnel drive was not taken forward as the latter site is in close proximity to public open space and would impact on local residential properties and users of the adjacent park. In addition the use of Convoy's Wharf would likely to be contrary to planning policies protecting amenity, open space, Metropolitan Open Land and views. There are a number of planning applications for residential development at Convoys Wharf, which have not been successful to date but further amended applications are expected, as well as significant heritage constraints. For these reasons this alternative was not taken forward.

3.7.107 At phase two consultation, the Mayor advised that "the preferred option is not acceptable...due to the proximity of the drop shaft being too close to the DLR viaduct". The proximity of the DLR viaduct and a number of additional concerns would need to be resolved by Thames Water to ensure that the use of this site was acceptable.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.01**

Volume 1: Introduction to the Environmental Statement

Appendix A: Code of Construction Practice

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

Hard copy available in

Box **15** Folder **A**
January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Appendix A: Code of Construction Practice

Please refer to separate stand-alone document

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.01**

Volume 1: Introduction to the Environmental Statement

Appendix B: Design Principles report

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

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Creating a cleaner, healthier River Thames

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Appendix B: Design Principles report

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Design Principles

Doc Ref: **7.17**

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

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Thames Tideway Tunnel
Design Principles

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1 Introduction

1.1 Scope of this report

1.1.1 This report describes the design principles that underpin the design of the permanent ground level and above-ground elements and spaces of the Thames Tideway Tunnel project (the 'project'). The above-ground elements include permanent structures in the river, ventilation structures or columns, ventilation buildings, electrical and control kiosks and potential new public space, footpaths and landscaping. The design principles apply to the permanent operational phase of the project; they do not apply to the temporary construction phase.

1.1.2 The principles were developed in consultation with local authorities and other stakeholders. They establish parameters that must be met in the final detailed design of the ground level and above-ground structures and spaces associated with the project. The principles serve a number of functions:

a. They have helped to inform the assessment of the likely environmental effects of the project in the Environmental Impact Assessment.

b. They have also helped to inform the project's sustainability strategy by demonstrating how sustainability objectives were implemented in the design of sites.

c. They set the parameters for the detailed plans to be prepared by contractors or others to satisfy the requirements that will be attached to the Development Consent Order (DCO).

d. The principles will be considered by the relevant local planning authorities alongside the DCO plans in assessing the detailed designs submitted for subsequent approval.

e. They help to illustrate how Thames Water has responded to public consultation feedback in relation to design.

f. They help to illustrate how Thames Water has taken account of the criteria for good design set out in the National Policy Statement for Waste Water (the 'NPS') in order to ensure that the development is as attractive, durable and adaptable as it can be, taking account of regulatory and other constraints.

1.1.3 This report is structured as follows:

a. Section 2 outlines the high-level design objectives. These are Thames Water's overarching objectives for the design of permanent structures on all sites.

b. Section 3 sets out the generic principles. These represent general project-wide commitments. However, they must be read in conjunction with the site-specific principles as they are not necessarily appropriate for each site. For example, lighting principles do not apply to sites where lighting is not required. A table at the beginning of each site-

specific section lists the generic principles that do not apply to that location.

c. Section 4 details the site-specific principles. These are contextual principles that are unique to each site or which elaborate further on the generic principles.

1.1.4 The principles work within the framework provided by the Site works parameter plans, the landscape plans and the other plans that form part of the application for development consent. They provide more detail of the design intent but still provide some flexibility to develop the detailed designs at a later date in the light of the prevailing circumstances when the project is implemented.

1.1.5 The design principles are submitted for approval as part of the application for development consent so subsequent design development and detailed plans must be in accordance with the principles.

1.1.6 The design principles help to ensure that the project meets the criteria in the NPS with regard to the following:

a. good design (para. 3.5.2 of the NPS)

b. locating odour sources away from sensitive developments, where practicable (para. 4.3.16 of the NPS)

c. ensuring any impacts on habitats are minimised and managed and opportunities are taken to enhance existing habitats or create new habitats of value, where practicable (para. 4.5.17 of the NPS)

d. demonstrating that adverse landscape and visual effects have been minimised through appropriate siting, and design, including colours and material and landscaping schemes (para. 4.7.17 of the NPS)

e. minimising the direct effects on existing land uses, or proposed uses near the sites by the application of good design principles, including the layout of the project (para. 4.8.19 of the NPS)

f. sustaining and, where appropriate, enhancing the significance of heritage assets and making a positive contribution to the character and local distinctiveness of the historic environment (para. 4.10.12).

2 High-level design objectives

2.1 Vision

2.1.1 The project would be a major, city-wide investment in London's wastewater infrastructure for the 21st century. It would build on Sir Joseph Bazalgette's legacy and maintain the long-term sustainability of London as a world-class city and improve the quality of its largest open space, the River Thames. This vision comprises the high-level design objectives which have guided the development of the scheme to date. The generic and site-specific design principles that follow will be used to test the acceptability of subsequent, more detailed design development.

2.1.2 In keeping with Bazalgette's tradition, any new public open spaces shall be designed to positively enhance the environment and provide a lasting legacy.

2.1.3 Site designs shall be of high quality and provide value. They shall respect each site's individual location and setting, while recognising the contribution of all sites to providing a cleaner, healthier River Thames.

2.1.4 Designs shall recognise the importance and quality of the engineering infrastructure below-ground. They shall meet safety, functional, environmental, maintenance and access requirements. The structures and finished surfaces shall be robust and of appropriate quality.

2.1.5 Thames Water's vision shall be achieved by:

a. Being responsible:

   i respecting and contributing positively to each site's individual context and surroundings

   ii reducing the impacts of operations on local communities, the environment and third party interests as far as reasonably practicable

   iii listening to and working with stakeholders, being open to new ideas and identifying areas of mutual interest with others

   iv challenging operational and functional requirements to create sites that meet the functional requirements, work within the day-to-day life of the city, and reflect local community and environmental considerations

   v ensuring that the principles of sustainability are integral to designs by incorporating environmental solutions and environmental mitigation

   vi developing a signature across the sites that recognises the collective importance of the project and the sites to the river.

b. Being flexible and creative:

   i where opportunities arise, we shall seek to create new, high quality, public spaces and enhance habitats and biodiversity

ii where there is existing site development, we shall work with known developers to find solutions that are conducive to both parties. Where development proposals are less certain, we shall provide flexible solutions to meet operational needs that are also able to respond to changing future circumstances

iii at existing Thames Water operational sites, designs shall be a simple expression of the functional requirements that respect the context and enhance the wider surroundings.

c. Meeting functional requirements

i developing high quality, well-designed and durable solutions that protect and respect the environment and amenity of the areas in which they are located

ii providing safe sites for operations staff and (where relevant) the public that are accessible to all

iii developing low maintenance solutions that meet operational and functional requirements using existing Thames Water assets wherever possible

iv ensuring that spaces that would be handed over to others could be maintained to a good standard in the long-term, having due regard to planning policy and best practice

v reinstating and extending the Thames Path where practicable.

3 Generic design principles

3.1 Integration of functional components

3.1.1 These principles apply to all sites unless stated otherwise in the table at the beginning of each site-specific section.

3.1.2 It is a high-level design objective that any new public open spaces shall be designed to enhance the environment and provide a lasting legacy. In order to realise this, the functional components shall be integrated in a way that supports and reinforces the visual success of the overall design. The following principles address how this shall be achieved.

Table 3.1 Integration of functional component principles

Reference	Integration of functional component principles
FNCC.01	The designs shall make efficient use of the land required for the project and land take shall be minimised. Buildings and materials shall be re-used, wherever practicable and economic.
FNCC.02	The ground-level surfaces of the works shall be integrated into the public realm without the need for fenced and gated compounds, except at sites which are within existing operational compounds (Thames Water or others) or subject to a planning proposal by other developers. Where development is proposed in a park, the landscape design for the location and layout of any areas of hardstanding shall be sympathetic to the character and nature of the park.
FNCC.03	The 'signature' design shall be used for all ventilation columns serving the shaft, except where stated otherwise in site-specific principles. The ventilation columns shall stand a maximum 8m high and have a minimum proportion of 1:5 (girth to height). Multiples of the signature design shall be used to achieve the cross-sectional areas required for ventilation.
FNCC.04	In parks and open spaces any above-ground structures shall be positioned on the park/site boundaries and adjacent to planting, as far as possible, so as not to obstruct views into and out of the space. In exceptional circumstances, above-ground structures may be designed as specific statement features that contribute to the character of the park.
FNCC.05	All above-ground structures shall be of high quality design and materials, appropriate to the context.
FNCC.06	Areas of hardstanding required for maintenance access shall be minimised wherever possible in order to reduce surface water run-off rates without compromising the functional requirements.
FNCC.07	In publicly accessible areas, large access covers (exceeding 675mm x 675mm) shall have durable recessed covers integrated into the surrounding paving treatment for visual continuity.

Reference	Integration of functional component principles
FNCC.08	In publicly accessible areas, small access covers (675mm x 675mm or less) shall be of a bespoke project design or be recessed covers inset with the surrounding paving treatment for visual continuity.
FNCC.09	Buildings and kiosks shall have a low-maintenance brown roof unless otherwise specified in site-specific principles in order to reduce surface water run-off rates and to promote biodiversity.

3.2 Heritage design principles

3.2.1 The NPS recognises the desirability of sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution they can make to sustainable communities and economic vitality. The decision maker should take into account the desirability of new development making a positive contribution to the character and local distinctiveness of the historic environment (para. 4.10.12). The following principles shall be applied at sites in sensitive heritage locations, unless specified otherwise in the table at the beginning of each site-specific section. Further detail is also available in the *Heritage Statement* and *Code of Construction Practice*.

Table 3.2 Heritage principles

Reference	Heritage principles
HRTG.01	Where interventions to the fabric of listed buildings or listed structures are proposed, they shall be designed to remove as little historic fabric as possible in order to ensure maximum retention of historic form and fabric.
HRTG.02	Modern structural and environmental designs that interface with listed buildings or structures shall respect the historic structural and environmental behaviour of the adjacent listed building or structure.
HRTG.03	Monitoring equipment for assessing the effect of the works on listed buildings and structures shall be designed to be unobtrusive and to ensure the significance of the listed building is undamaged.
HRTG.04	Facing materials and detailing shall be compatible with the visual character of existing adjacent listed buildings and heritage assets.
HRTG.05	Designs shall aim to support the legibility of the key historic functions of heritage assets.
HRTG.06	Alterations to historic fabric shall be reversible, wherever reasonably practicable.
HRTG.07	Interpretive material shall be provided at sites of heritage value where this would be of wider public benefit. The design of interpretation materials shall not lead to unacceptable visual clutter. Interpretation shall be undertaken in line with a project-wide Interpretation Strategy and shall take account of any existing local interpretation strategies.
HRTG.08	Trees that need to be removed in a conservation area shall be replaced as close as possible to the original position with a species that relates to the character of the area. For new trees, reference shall be made to the principles outlined in the Mayor of London's *London Trees and Woodland Framework. Right Place, Right Tree initiative*.

3.3 Riparian and in-river structure principles

3.3.1 Unless specified otherwise in the table at the beginning of each site-specific section, the following principles apply to foreshore structures, new flood defence walls and reinstated flood defences.

Table 3.3 Riparian and in-river structure principles

Reference	Riparian and in-river structure principles
IRVR.01	Structures in or over the river shall be reduced in scale as far as possible and be designed to take account of effects on river flow, the needs of river users, aquatic ecology and visual effects.
IRVR.02	As a minimum, all new flood defences shall provide the same level of protection against flooding as the existing defences and be designed to accommodate the raised levels specified in the Environment Agency's TE2100 Guidance at an appropriate time in the future.
IRVR.03	New foreshore structures shall be publicly accessible except during essential maintenance when they would be closed to the public.
IRVR.04	Lifesaving equipment on the river wall shall tie in with any existing safety features and comply with the Port of London Authority (PLA) recommendations in the *Review of lifesaving provision along the tidal Thames 1994.*
IRVR.05	Facing materials and detailing for new river walls shall be compatible with the visual character of existing adjacent river walls.
IRVR.06	Horizontal or vertical timber fenders shall be included in the design of river walls in order to promote aquatic ecology.
IRVR.07	Horizontal demarcations shall be designed on the new river walls to mark pertinent river levels (such as the highest astronomical tide, mean high water springs etc) across the project.
IRVR.08	Navigational aids including signage and lighting shall be provided where required by the PLA.
IRVR.09	The aprons of any existing outfalls made redundant by the project shall be broken out and removed where practicable, unless required for scour protection.
IRVR.10	Appropriate scour protection shall be provided beneath any new outfall to prevent excessive scouring of the foreshore and to protect the foundation of the river wall. The detailed design and extent of this shall seek to avoid or minimise adverse effects on aquatic ecology.
IRVR.11	Where practicable, suitable habitat shall be provided at the base of any foreshore structure to encourage retention of sediment in order to promote aquatic ecology.
IRVR.12	Any moorings affected by the works shall be replaced, where practicable, unless otherwise agreed with the Port of London Authority.

Reference	Riparian and in-river structure principles
IRVR.13	Any flood defences that are directly impacted shall be reinstated to an appropriate standard.

3.4 Landscape design principles

3.4.1 These principles apply to all sites unless specified otherwise in the table at the beginning of each site-specific section.

Table 3.4 Landscape design principles

Reference	Landscape design principles
LSCP.01	Designs shall seek to provide a net increase in trees over the project as a whole. Where practicable, any trees which are removed shall be replaced as close as possible to the current position or within close proximity to the site, in line with a coherent landscape design.
LSCP.02	For new trees, reference shall be made to the principles outlined in the Mayor of London's *London Trees and Woodland Framework. Right Place, Right Tree initiative*. They shall be native species except where non-native species (eg, London Plane) are chosen for their townscape value. Species may be selected for their resilience to a demanding urban environment or climate change where a biodiversity benefit can also be demonstrated.
LSCP.03	Where possible, large tree pits shall be provided to maximise tree size and growth potential. Such measures increase the tree's access to space and light and reduce the potential for vandalism.
LSCP.04	Any public furniture, fencing or railings shall be robust, durable and in keeping with the character of the surrounding townscape. Reference shall be made to any relevant local street design guides for specification of landscape elements.
LSCP.05	The design shall be developed with reference to relevant guidance on safety and security, including Secured by Design, Design Council CABE guidance and the Centre for the Protection of National Infrastructure and National Counter-Terrorism Security Office's *Protecting Crowded Places* design guidance.
LSCP.06	Publically accessible spaces shall be designed to be safe and inclusive and consider the needs of the diverse communities within the city. In line with current best practice the following shall apply as a minimum: a. Gradients shall be kept as shallow as possible, preferably no steeper than 1:21. b. On graded routes (1:21 to 1:60) level rest areas shall be provided at a minimum of 10m intervals. c. Surface colour contrast and 'corduroy' strips shall be used at landings to steps and ramps where appropriate to enable visually impaired persons to use and anticipate them. d. Where external stairs are provided, a step-free alternative shall also be provided. e. Where stairs are provided, they shall be designed in accordance with Part M (Approved Document M) of Schedule 1 of the Building Regulations.

Reference	Landscape design principles
	f. A minimum of 2.3m clear height shall be allowed under overhangs, structures, signage and tree canopies.
LSCP.07	Walkways shall be an adequate width to allow wheelchair users to pass one another comfortably (a minimum of 2m wherever practicable).
LSCP.08	Designs shall seek to improve access for pedestrians and cyclists, wherever practicable and economic, while meeting functional requirements.
LSCP.09	Clear lines of sight shall be maintained throughout pedestrian environments in order to maximise accessibility, reduce visual confusion, and reduce dependence on signage and auditory information.
LSCP.10	Materials shall be selected for safety and accessibility and footway surfaces shall be firm, level and slip-resistant. Where paving is provided, larger setts/slabs shall be used where practicable to minimise the risk of trapping wheels or other walking aids.
LSCP.11	Materials shall be robust, durable and meet the technical requirements of the project.
LSCP.12	In areas of public realm, paving materials shall relate to and reflect the character of the surrounding townscape.
LSCP.13	Surfaces and sub-surfaces in operational areas shall be constructed to support heavy machinery and vehicles.
LSCP.14	Where appropriate, existing materials shall be reused within the landscape design.
LSCP.15	Surface materials within existing Thames Water compounds shall be robust and comply with Thames Water’s standard requirements.
LSCP.16	Any cycle parking spaces affected by the Works shall be re-provided, where practicable.

3.5 Lighting design principles

3.5.1 In general, new operational lighting shall not be provided as part of the project. The principles in Table 3.5 apply specifically to sites where newly created areas of public realm would be accessible at night. They do not apply to the reinstatement of existing lighting. These principles apply unless stated otherwise in the table at the beginning of each site-specific section.

Table 3.5 Lighting design principles

Reference	Lighting design principles
LTNG.01	Light pollution at sites shall be minimised by means of capped, directional and cowled lighting units. Lighting design shall adhere to the principles outlined in *Bats and Lighting in the UK*[1] produced by the Bat Conservation Trust in partnership with the Institute of Lighting Engineers.
LTNG.02	In heritage locations, lighting proposals shall respect adjacent historic elements and be co-ordinated with wider lighting objectives.
LTNG.03	In heritage locations, the colour temperature of light sources shall complement and enhance the colours of adjacent buildings and the wider landscape setting.
LTNG.04	Lighting designs shall seek to reduce the risk of accidents and help to prevent crime and the fear of crime. However, this shall be balanced with the need to produce high quality attractive design, reduce light pollution and promote terrestrial and aquatic biodiversity.
LTNG.05	Dark patches and high light/dark contrasts shall be avoided as they can impair visibility.
LTNG.06	Localised lighting of shrubberies, trees and flowerbeds may be used to create a contrasting effect at night. This shall be determined on a site-by-site basis.
LTNG.07	Where appropriate, lighting shall be integrated into seating, steps, walls and other furniture and features in order to reduce visual clutter.
LTNG.08	Lighting units shall be high quality and robust. The ease of future maintenance shall be a relevant consideration to the choice of detailed light fittings.
LTNG.09	Lighting shall not be proposed for the River Thames or directed towards it, except where required for navigational safety.
LTNG.10	Lighting sources shall be selected to be aesthetically appropriate and to limit light pollution, improve energy efficiency and increase equipment longevity.

[1] http://www.bats.org.uk/publications_download.php/243/BATSANDLIGHTINGINTHEUKJan08.pdf

3.6 Site drainage principles

3.6.1 The following site drainage principles shall apply, unless stated otherwise in the table at the beginning of each site-specific section. In areas that would be incorporated into developments by others, the third-party developer shall determine the final site drainage arrangement, subject to their obtaining a separate consent.

Table 3.6 Site drainage principles

Reference	Site drainage principles
SDRN.01	Site drainage shall comply with the National Standards for Sustainable Drainage Systems under the Floods and Water Management Act 2010.
SDRN.02	Site drainage at foreshore sites and sites immediately adjacent to the tidal river shall be designed to discharge surface water run-off directly into the river. In the event of a storm coinciding with a high tide event, surface water drainage from the site may be restricted and would need to be stored on-site. If necessary, on-site storage would be provided to manage the risk of site flooding in the event of tide-locking of the surface water outfall.
SDRN.03	At greenfield and park sites, site drainage shall be designed to ensure that post-development surface water run-off rates do not exceed existing rates.
SDRN.04	At brownfield sites, site drainage shall comply with the Mayor's Essential Standard as follows: a. use Sustainable Drainage Systems measures, wherever practical b. achieve 50 per cent attenuation of the undeveloped site's peak surface water run-off at peak times.
SDRN.05	For outfalls with a diameter of 300mm or greater two means of preventing the back up of river water shall be provided (eg, two rows of flap valves).

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4 Site-specific design principles

4.1 Acton Storm Tanks

Table 4.1 Generic site information

Site name: Acton Storm Tanks	
DCO Work No.	2
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.03 and FNCC.04
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	LSCP.01, LSCP.06 and LSCP.12
Lighting design principles	LTNG.02, LTNG.03 and LTNG.09
Site drainage principles	SDRN.02, SDRN.03 and SDRN.05

4.1.1 The project works would be located within an existing Thames Water operational site. Consequently principles relating to integration of functional components (in the public realm) have been dis-applied.

Table 4.2 Acton Storm Tanks site-specific design principles

Reference	Site-specific design principles
ACTST.01	A single vehicular maintenance access to the project works shall be provided from Canham Road. This access shall be used infrequently by larger vehicles to enable them to turn within the site. Access for frequent visits by smaller vehicles shall be via the Acton Storm Tanks existing site access from Warple Way/Canham Road.
ACTST.02	Provision shall be made to extend the width of the footpath on Canham Road to a minimum of 2m, using land within the Thames Water site. The footpath shall be constructed to adoptable standards.
ACTST.03	Sustainable drainage shall be provided (as shown on the indicative Landscape plan), in order to comply with the generic site drainage principles. This shall be maintained by Thames Water as part of the operational site.
ACTST.04	The design of the ventilation column shall be bespoke and help to mark it as a local landmark, enhance the local townscape and celebrate the project. The form of the column shall make visual reference to the signature design in order to achieve consistency with other sites and it shall be clad in a high quality, robust material.

Reference	Site-specific design principles
ACTST.05	The ventilation column and structure shall preferably be located close to the Canham Road frontage, in order to reduce the visual effects on properties to the west and to locate the column nearer to similar height buildings and in a prominent location near the public footpath.
ACTST.06	Advanced tree planting along Warple Way shall be undertaken prior to site clearance and construction in order to partially screen views of the site. Material piles potentially used by hedgehogs and notable invertebrates shall be relocated within the advanced planting.
ACTST.07	Fences to the north and west of the site shall be replaced with a new high quality boundary treatment. The extent of this fencing shall be as shown on the proposed landscape plan.
ACTST.08	At least five bat boxes shall be attached to the mature trees retained on-site.
ACTST.09	The existing lighting scheme for the compound shall be reinstated.
ACTST.10	Species-rich wildflower grassland, native trees and scrub shall be provided in appropriate areas as part of the reinstatement of the construction site.

4.2 Hammersmith Pumping Station

Table 4.3 Generic site information

Site name: Hammersmith Pumping Station	
DCO Work No.	3
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.03 and FNCC.04
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	LSCP.01, LSCP.02, LSCP.03 and LSCP.04
Lighting design principles	All (ie, no principles apply)
Site drainage principles	SDRN.02, SDRN.03 and SDRN.05

4.2.1 Thames Water is not responsible for any landscaping works outside the wall of the permanent operational site compound. A legal agreement is in place between Thames Water and St George, the developer of Fulham Reach. The detailed designs for this site, and the responsibilities for implementation, shall reflect this agreement.

Table 4.4 Hammersmith Pumping Station site-specific design principles

Reference	Site-specific design principles
HAMPS.01	The electrical and control equipment shall be located within the existing pumping station building. The local penstock isolation kiosk shall be located on the external wall of the pumping station.
HAMPS.02	All above-ground structures shall be located within the Thames Water operational site.
HAMPS.03	The extended and rebuilt compound wall facing Chancellor's and Distillery Roads shall match the construction of the existing precast concrete wall. Walls and fencing to the south and west shall be sympathetic to the new residential development.
HAMPS.04	Any structures outside the Thames Water compound shall be designed to be incorporated into the public realm of the residential development that will be completed by others.
HAMPS.05	No lighting shall be provided, unless incorporated as part of the adjacent residential development.
HAMPS.06	The ventilation column shall be combined with the existing Venturi ventilation superstructure on the site. The combined structure shall either match the existing elevations or be re-clad with materials appropriate to their context. The signature design ventilation column shall not be used.

Reference	Site-specific design principles
HAMPS.07	If the Screen House is removed, then it shall be replaced with a structure(s) that shall not exceed the height and footprint of the existing Screen House building.
HAMPS.08	Bat roost features for common pipistrelle and soprano pipistrelle bats shall be mounted in mature trees along Chancellor's Road on land owned by Thames Water.
HAMPS.09	The three trees to be removed as part of the construction works shall not be replaced, in accordance with LSCP.01, as the proposed landowner will include the area within their subsequent development site and landscaping proposals.

4.3 Barn Elms

Table 4.5 Generic site information

Site name: Barn Elms	
DCO Work No.	4
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.03
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	LSCP.07, LSCP.08, LSCP.09 and LSCP.12
Lighting design principles	LTNG.02, LTNG.03, LTNG.06, LSCP.07 and LSCP.09
Site drainage principles	SDRN.02 and SDRN.04

4.3.1 Alternative changing room facilities shall be provided of equal capacity to the facility scheduled for demolition as part of the access road proposals. The facilities shall be located in close proximity to the existing changing room facilities. The exact specification and location of the alternative facilities shall be agreed in advance with the site owners. The alternative changing room facilities shall be constructed, commissioned and made available for use prior the closure of the existing facilities.

4.3.2 Relocated track and field facilities shall be provided to offset the removal of existing facilities as part of the access road proposals. The new facilities shall be located in close proximity to the existing facilities. The exact location of the facilities shall be agreed with the land owner prior the removal of the existing facilities. The facilities shall be constructed and made available for use prior to the removal of the existing facilities.

Table 4.6 Barn Elms site-specific design principles

Reference	Site-specific design principles
BAREL.01	Replacement changing room facilities shall be located in close proximity to the existing facilities scheduled for demolition. The relocated track and field facilities shall be moved to locations agreed by the local planning authority in consultation with the landowner.
BAREL.02	The permanent works shall be located as close as possible to the perimeter of the site, incorporating an 8m buffer from the embankment to the Beverley Brook. This would allow for flexibility in the reconfiguration and relocation of the playing fields without compromising Thames Water's access and maintenance arrangements.

Reference	Site-specific design principles
BAREL.03	Vehicular maintenance access shall be from the north along the eastern edge of the playing fields. The surface of this route shall be reinforced grass and the construction shall be capable of supporting operational maintenance vehicles, plant or equipment. The vehicular maintenance access shall be located to avoid impact on mature trees.
BAREL.04	The above-ground structures shall be positioned in a planting and landform scheme sympathetic to the character of a tree-dominated backdrop and amenity grass (playing field) foreground, when viewed from within the playing fields, as illustrated on the indicative landscape plan.
BAREL.05	The extent of hardstanding shall be reduced as far as practicable to maintain the character of the playing fields and reduce surface water run-off.
BAREL.06	There shall be no security fence; therefore the structures shall be designed to be publicly accessible. The designs shall make provision for high security doors and manhole covers, as well as an appropriate void ratio for the cladding of the structure.
BAREL.07	The design shall accommodate the raised level required for the shaft and other hydraulic structures in a grass covered hardstanding area for operational maintenance, capable of supporting heavy plant.
BAREL.08	The signature design ventilation column shall not be used. The electrical and control kiosk and ventilation column shall be combined into a single structure. The combined structure shall have a brown roof and the walls shall be finished to promote biodiversity.
BAREL.09	No lighting shall be provided, except a low level light to the kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall only be activated by a directional motion control switch, linked to the door opening.
BAREL.10	Landscaping shall include semi-improved acid to neutral grassland to promote biodiversity around operational structures and along the operational access road without impinging on the use of the playing fields. A maintenance schedule shall be produced and implemented in such areas.
BAREL.11	A minimum of 15 bat boxes shall be installed in re-provided trees and on existing trees in order to promote biodiversity. New trees shall be of an appropriate height and growth pattern in order to physically accommodate bat boxes and to increase the chance of successful use by bats.
BAREL.12	A minimum of ten bird boxes for small bird species shall be attached to mature trees or dense shrub/under storey species may be planted in order to promote biodiversity. A maintenance schedule for bird boxes and shrub planting shall be produced and implemented.

4.4 Putney Embankment Foreshore

Table 4.7 Generic site information

Site name: Putney Embankment Foreshore	
DCO Work No.	5
Generic design principles	**Principles that do not apply**
Integration of functional components	None (ie, all principles apply)
Heritage principles	None (ie, all principles apply)
Riparian and in-river structure principles	None (ie, all principles apply)
Landscape design principles	None (ie, all principles apply)
Lighting design principles	None (ie, all principles apply)
Site drainage principles	SDRN.03 and SDRN.04

Table 4.8 Putney Embankment Foreshore site-specific design principles

Reference	Site-specific design principles
PUTEF.01	In order to minimise the visual and physical impact on the listed bridge, the top of the interception chamber shall sit below the springing point of the bridge arch and be as small as possible. The interception chamber shall be set back from the main bridge elevations as far as possible to maintain the architectural integrity of the existing bridge.
PUTEF.02	The interception chamber shall be finished in high quality, fair-faced concrete that complements the existing finish of the bridge.
PUTEF.03	In order to minimise the size of the CSO interception chamber (see PUTEF.01 above) and maintain hydraulic integrity, there shall be no openings such as access covers and flap valve openings in the structure.
PUTEF.04	Level access to the shaft foreshore structure shall be provided for maintenance vehicles via the Embankment/Lower Richmond Road.
PUTEF.05	The surface of the foreshore structure shall sit at or above current flood defence level.
PUTEF.06	The electrical and control equipment shall be housed in two structures. The main kiosk shall be located on Waterman's Green and a smaller kiosk on the foreshore structure.
PUTEF.07	The design and materials of the facades of the main kiosk shall match the existing bridge abutment wall. The design and layout of this kiosk shall accommodate the continued use of an existing ventilation louvre located within the abutment wall.
PUTEF.08	The main kiosk shall be as narrow in depth as possible (ie, to minimise the extent to which it protrudes off the existing wall) to maximise space on Waterman's Green.

Reference	Site-specific design principles
PUTEF.09	The cable and ducting route to the main kiosk shall run partially beneath Waterman's Green but mostly beneath the pavement and road surface in order to protect tree roots and avoid disturbance to the Green.
PUTEF.10	Maintenance access to the main kiosk shall be on foot via Waterman's Green; no vehicular access shall be provided, except in emergencies when vehicles would need to park on the adjacent public drawdock/slipway or carriageway.
PUTEF.11	No new lighting shall be provided to Waterman's Green except for a low level light to the kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall only be activated by a directional motion control switch, linked to the door opening.
PUTEF.12	The kiosk on the foreshore structure shall be positioned to mark the western junction with the existing embankment and mediate the level change between the pavement and the foreshore structure. It shall be finished in way that enhances the public realm with the inclusion of public art, possibly incorporating historic interpretive information on the area and maritime events. Any public art at this site shall be procured in close collaboration with the local authority's Arts Team.
PUTEF.13	The design of the interception ventilation column (positioned on the listed bridge) shall be appropriate to the listed structure and in keeping with the character of surrounding street furniture.
PUTEF.14	The layout of the permanent works shall minimise any visual and physical effects on the existing slipway and avoid the need for alterations. Any slipway materials that are disturbed by the works shall be removed with care, stored and reinstated to the existing standard. The works shall not prejudice the possibility of widening the slipway in the future by others.
PUTEF.15	Provision shall be made for the potential extension of the platform to reduce the accumulation of sediment/debris in the foreshore area between the existing river walls and the foreshore structure.
PUTEF.16	The edge treatment of the foreshore structure shall facilitate the mooring of vessels, except immediately in front of the new CSO outfall where mooring is prohibited. The handrail shall be set back from the river's edge and it shall not incorporate any removable sections, except for vessel loading, if required.
PUTEF.17	The foreshore structure sits on the starting line of the University Boat Race. The University Boat Race stone shall be retained in its current position. A physical marker shall run from the stone to the new river wall. The marker shall have a detailed treatment and could feature as a work of public art.
PUTEF.18	The design of the kiosk on the foreshore structure shall incorporate a segregated electrical connection that is protected against water for use by the local authority.

Reference	Site-specific design principles
PUTEF.19	The river wall of the permanent foreshore structure shall be finished in natural stone with vertical timber fenders on the outer face and horizontal fenders on the upstream and downstream faces.
PUTEF.20	The listed bollards shall be carefully removed, stored and reinstated. They shall be relocated in the vicinity of their current positions in keeping with the revised layout and access requirements.
PUTEF.21	The size and layout of the foreshore structure shall allow for a pier to be constructed from it in the future by others. The design shall also include provision of an access zone across the structure to Putney Embankment during project maintenance activities.
PUTEF.22	The foreshore structure shall facilitate the loading and unloading of vessels at its eastern end. Above-ground structures shall not be located in this area to ensure this activity is unobstructed.
PUTEF.23	The Holly tree that would be removed from Waterman's Green during construction shall be replaced with another tree at a location to be agreed with the local authority.
PUTEF.24	Bat boxes for common pipistrelle and soprano pipistrelle bats shall be attached to trees on and adjacent to the site. They shall be located to ensure that they would not be disturbed during construction and to avoid disturbance from lighting.

4.5 Dormay Street

Table 4.9 Generic site information

Site name: Dormay Street	
DCO Work No.	8
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.03 and FNCC.04
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	IRVR.03, IRVR.10 and IRVR.12
Landscape design principles	LSCP.01 to LSCP.04 and LSCP.06 to LSCP.09
Lighting design principles	All (ie, no principles apply)
Site drainage principles	SDRN.03 and SDRN.04

Table 4.10 Dormay Street site-specific design principles

Reference	Site-specific design principles
DRMST.01	The electrical and control kiosk and ventilation column shall be combined into a single structure. The signature design ventilation column shall not be used.
DRMST.02	No operational lighting shall be provided to the Thames Water works except for a low level light to the kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall only be activated by a directional motion control switch linked to the door opening.
DRMST.03	Existing operational lighting to the depot areas shall be retained or reinstated.
DRMST.04	Thames Water vehicular maintenance access shall be required from Dormay Street.
DRMST.05	The permanent works shall be positioned to allow for the future provision of a river walkway with a minimum width of 4m from the edge of the kiosk to the river wall.
DRMST.06	A detailed assessment of the existing river wall shall be carried out prior to construction. Should the wall require strengthening, substantial renovation or rebuilding, it shall be reconstructed to enable provision for biodiversity. Furthermore, it shall be designed to support the forecast raised flood defence levels stipulated in the Environment Agency's Thames Estuary 2100 Guidance. The wall finishes shall relate to the surroundings and in agreement with the Environment Agency, the wall shall incorporate horizontal fenders to enable accretion and potential habitat for vegetation and invertebrates.

Reference	Site-specific design principles
DRMST.07	An operational refuge shall be provided around the kiosk and a valve chamber using bollards to maintain 24-hour access and to protect against vehicle strike, unless agreed otherwise in writing with the local authority.
DRMST.08	A section of river wall on the southern side of Bell Lane Creek east of the shaft location shall be altered at the end of the construction period to incorporate an inter-tidal terrace.
DRMST.09	Replacement tree and scrub planting shall be provided for vegetation lost during construction adjacent to Bell Lane Creek to restore the corridor for the movement of and foraging resource for bats, and a nesting and foraging resource for birds.

4.6 King George's Park

Table 4.11 Generic site information

Site name: King George's Park	
DCO Work No.	9
Generic design principles	**Principles that do not apply**
Integration of functional components	None (ie, all principles apply)
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	None (ie, all principles apply)
Lighting design principles	LTNG.02 and LTNG.03
Site drainage principles	SDRN.02, SDRN.04 and SDRN.05

4.6.1 Thames Water shall develop detailed landscape proposals in agreement of the London Borough of Wandsworth. The proposals may include tree planting within the park in advance of site clearance and construction in order to screen views. Advanced tree planting shall include measures such as bat boxes to reduce impacts on biodiversity. Post construction, planting shall be maintained by the London Borough of Wandsworth.

Table 4.12 King George's Park site-specific design principles

Reference	Site-specific design principles
KNGGP.01	The planting and landscape design shall reinforce edge planting at the park boundaries within the site boundary. The existing cast iron railings and gates shall be re-used, where possible and practicable, as part of the new park boundary fronting Buckhold Road.
KNGGP.02	The existing avenue of trees along the eastern edge of the park, which terminates at the north end with Black Poplar and Red Oak trees, shall be retained, with the exception of trees shown on the Demolition plan for removal and the possible pruning of the Red Oak.
KNGGP.03	The design shall consider and accommodate plans for alternative/additional pedestrian access to the park at the corner of Neville Gill Close and Buckhold Road as shown on the indicative Landscape Plan, to be agreed in more detail with the local authority.
KNGGP.04	The design shall link the following points and ensure the links are easy to follow for pedestrians and respond to the future development of the northern end of the park: a. the existing main gates b. the path to the west of the lake c. the path to the east of the lake

Reference	Site-specific design principles
	d. the reconfiguration of the entrance and footpaths at the northern end of the park (see above).
KNGGP.05	The area of hardstanding shall be reduced as far as practicable. All new paths and areas of hardstanding shall be surfaced in resin bonded gravel, wherever possible and practicable. The exact specification shall be agreed with the local planning authority.
KNGGP.06	The design shall maximise the amount of soft landscaping within the site boundary to maintain the character of the park and improve surface water drainage. At least four specimen trees shall be used along the north western boundary.
KNGGP.07	Maintenance vehicle access for Thames Water shall be via Neville Gill Close.
KNGGP.08	The design shall accommodate the raised level required for the shaft and interception structures within a coherent landscape design for the park.
KNGGP.09	The John Young tree and memorial bench shall be protected and retained in its current position in the final design.
KNGGP.10	The design shall incorporate the provision of a separate secure power and water supply to the area of hardstanding installed as part of the project for use by the local planning authority for a mobile café if required.
KNGGP.11	A low level light shall be provided to the kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall only be activated by a directional motion control switch, linked to the door opening. In addition, low level lighting shall be provided at the entrance, along the steps around the permanent platform of the works.
KNGGP.12	The design shall incorporate re-contouring of the site to improve flood plain flow characteristics as agreed with the Environment Agency. This would require part of the existing site adjacent to the shaft to be lowered by up to 700mm. Re-contouring shall be in keeping with the character of the park and the overall landscape design for the site. Any approved Environment Agency Flood Alleviation Scheme should be considered during construction, with designs amended accordingly, wherever practical.
KNGGP.13	On completion of the works approaches such as gaps in fence bottoms and railings shall be provided where appropriate, in order to allow hedgehogs free transit through the site.
KNGGP.14	The landscape design shall include suitable ground treatment and planting structures in order to promote natural colonisation by terrestrial invertebrates. Replacement trees shall include semi-mature and specimen trees.

Reference	Site-specific design principles
KNGGP.15	Advanced planting shall be undertaken prior to site clearance and construction in order to partially screen views of the site during construction. The advanced planting shall comprise tree planting along the path that runs adjacent to the lake and continues for a short distance where the path forks towards Buckhold Road and towards the site. This advanced planting would be retained in the operational phase.

4.7 Carnwath Road Riverside

Table 4.13 Generic site information

Site name: Carnwath Road Riverside	
DCO Work No.	6
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.03
Heritage principles	HRTG.02, HRTG.06, HRTG.07 and HRTG.08
Riparian and in-river structure principles	None (ie, all principles apply)
Landscape design principles	None (ie, all principles apply)
Lighting design principles	LTNG.02 and LTNG.03
Site drainage principles	SDRN.03 and SDRN.04

Table 4.14 Carnwath Road Riverside site-specific design principles

Reference	Site-specific design principles
CARRR.01	The works shall retain the existing surface water drainage regime as far as possible.
CARRR.02	The surface of the shaft shall be incorporated into a new area of landscaped public space that can be integrated into the wider development of the area. The top of the shaft slab shall be buried 1m below the finished surface level to enable tree planting and soft landscaping.
CARRR.03	The new public area shall strengthen the links between Carnwath Road and the river by improving visual and pedestrian permeability across the site.
CARRR.04	The landscape treatment shall screen the space from the traffic effects of Carnwath Road allowing for framed views.
CARRR.05	The ventilation building and the separate ventilation column shall either be positioned on the eastern boundary of the site to create a buffer between Whiffin Wharf and the adjacent safeguarded wharf or, if it can be integrated into a development of the site by others.
CARRR.06	The architectural treatment of the ventilation building and boundary shall coordinate with and complement the landscape design for the space.
CARRR.07	A detailed assessment of the existing river wall shall be carried out prior to construction. Should it require rebuilding or strengthening as a result of the project works, it shall be constructed to enable provision to be made for biodiversity.

Reference	Site-specific design principles
CARRR.08	All shaft access openings and covers shall be located within the boundary of Whiffin Wharf.
CARRR.09	The ventilation column shall stand a maximum of 15m high and have a minimum proportion of 1:4 (girth to height). The ventilation column shall be maintainable from the outside, eg, for the replacement of any lighting cabling, conduits and cladding.
CARRR.10	The height and cross-section of the ventilation requirements at this site preclude the use of the signature design ventilation column. However, the form and design of the column shall make a visual reference to the signature design for consistency with other sites.
CARRR.11	The design of the ventilation column shall mark it as a local landmark and enhance the local townscape. In particular, it should mark a 'moment' from the river. If the final design for the ventilation column incorporates lighting, any provisions deemed necessary by the Civil Aviation Authority shall be accommodated as the site is on the approach to Battersea Heliport.
CARRR.12	Lighting shall be provided to the Thames Path and new public area in accordance with the lighting design principles.
CARRR.13	The site layout shall leave sufficient space to accommodate a feasible footprint for residential development at the western end of the Whiffin Wharf site. No operational assets, buried or otherwise, shall be sited west of the shaft's external diameter.
CARRR.14	The layout of the permanent works shall not compromise the viability of the future use of Hurlingham Wharf as a safeguarded wharf, in accordance with its designation by the Greater London Authority.
CARRR.15	New hand railing shall be provided on the river wall in accordance with ROSPA guidance.
CARRR.16	The building and boundary to the eastern edge of Whiffin Wharf shall be clad in the same high quality materials. The selection of materials shall comply with the *Sands End Conservation Area Appraisal* for the river corridor.
CARRR.17	London Plane trees shall be used where appropriate, to supplement native planting and enhance the landscape design of the site.
CARRR.18	The four trees proposed for removal to facilitate the Carnwath Road/Wandsworth Bridge Road junction improvement shall be replaced as close as possible to their existing locations.
CARRR.19	High quality secure hoardings shall be left around the boundary of Hurlingham Wharf and the Carnwath Road industrial area.
CARRR.20	The roof of the ventilation building shall be mono-pitched and feature water collection along the western perimeter to make maintenance easier.

Reference	Site-specific design principles
CARRR.21	The Riverside Walkway shall be a minimum width of 6m along the river frontage of Whiffin Wharf, excepting the ventilation column which encroaches into this width.
CARRR.22	There shall be no vehicular access to the new area of public realm except for project maintenance purposes unless agreed otherwise with the appropriate authority.
CARRR.23	Nesting features shall be provided at appropriate locations on-site for nesting black redstarts. This has the potential to increase the population of this species of conservation concern in London and the UK.

4.8 Falconbrook Pumping Station

Table 4.15 Generic site information

Site name: Falconbrook Pumping Station	
DCO Work No.	10
Generic design principles	**Principles that do not apply**
Integration of functional components	None (ie, all principles apply)
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	None (ie, all principles apply)
Lighting design principles	LTNG.02 and LTNG.03
Site drainage principles	SDRN.02, SDRN.03 and SDRN.05

4.8.1 Tree planting shall be undertaken within the park in advance of site clearance and construction to screen views of the Pumping Station. This shall be agreed in consultation with the London Borough of Wandsworth. Advanced tree planting shall include measures such as bat boxes to reduce impacts on biodiversity. Planting shall be maintained in the long-term by the London Borough of Wandsworth.

Table 4.16 Falconbrook Pumping Station site-specific design principles

Reference	Site-specific design principles
FALPS.01	The area outside the compound shall be publicly accessible at night, so new lighting shall be provided in accordance with the lighting principles.
FALPS.02	The design shall accommodate the raised level required for the shaft and combined valve/interception structures.
FALPS.03	Thames Water operational vehicular maintenance access shall be through York Gardens to the east.
FALPS.04	The existing pumping station compound wall shall be reinstated in its current position. An open section of wall with railings shall be incorporated to provide a line of sight between the pumping station compound and the shaft. Demountable railing/gated access shall be provided adjacent to the raised interception chamber structure to allow maintenance access.
FALPS.05	Pedestrian only access shall be provided to the area outside of the pumping station compound area, except for maintenance access by Thames Water vehicles.
FALPS.06	The design of the ventilation column shall be bespoke as the column would be located in the pumping station compound.
FALPS.07	The landscape design shall respond positively to the local authority's emerging Landscape Management Strategy for the York Gardens area.

Reference	Site-specific design principles
FALPS.08	Advanced planting shall be undertaken prior to site clearance and construction at the perimeter of the pumping station compound in order to screen views of the Pumping Station and Sub Station buildings and the compound. The advanced planting shall comprise tree planting, which would be retained in the operational phase.
FALPS.09	Planting shall comprise native deciduous trees and other robust, low-maintenance shrubs that provide seasonal variety. The scheme shall also facilitate the local authority's aspiration to improve the biodiversity value of York Gardens.
FALPS.10	The existing advertising screen shall be permanently removed.
FALPS.11	Cobbles from the existing paving in the area around the pumping station shall be reused in the final proposals.
FALPS.12	The entrance gates to the pumping station compound may be relocated along the southern façade to accommodate the functional requirements.
FALPS.13	A pedestrian access from York Way to York Gardens shall be reinstated.
FALPS.14	Bat boxes for a range of bat species shall be provided at suitable locations in York Gardens. The number of bat boxes, locations and method of attachment to trees shall be agreed with the local authority.
FALPS.15	Ground treatments shall incorporate areas of shaded, exposed earth to promote natural colonisation by terrestrial invertebrates.

4.9 Cremorne Wharf Depot

Table 4.17 Generic site information

Site name: Cremorne Wharf Depot	
DCO Work No.	11
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.04
Heritage principles	HRTG.07 and HRTG.08
Riparian and in-river structure principles	IRVR.01 to IRVR.03, IRVR.05 to IRVR.07, IRVR.10 and IRVR.12
Landscape design principles	All (ie, no principles apply)
Lighting design principles	All (ie, no principles apply)
Site drainage principles	SDRN.03 and SDRN.04

4.9.1 In order to construct the works, Thames Water would need to demolish the existing depot facilities, which it proposes to reinstate. However, it was not possible to determine a full brief for such facilities and the landowner is unclear as to what they would require in terms of facilities upon completion. Therefore consent is being sought for the principle of a reinstated depot building and its maximum height and massing, without any further details.

Table 4.18 Cremorne Wharf Depot site-specific design principles

Reference	Site-specific design principles
CREWD.01	On completion of the project, the depot facilities shall be reinstated unless agreed otherwise with the landowner.
CREWD.02	The footprint, scale and design of the reinstated depot facilities shall respect the historic setting of the listed pumping station.
CREWD.03	The layout of the permanent works shall not compromise the viability of the site as a safeguarded wharf, in accordance with its designation by the Greater London Authority.
CREWD.04	The signature design ventilation columns shall be located as close to the river as practicable. The vent columns shall not be flood lit.
CREWD.05	Electrical and control equipment located in the Lots Road pumping station shall be freestanding away from the existing tiled walls. The tile wall finish to the pumping station shall not be removed unless approved by the local planning authority.
CREWD.06	A local control pillar shall be located externally, adjacent to the rear wall of the Thames Water pumping station building with a line of sight to the access covers for the CSO interception structure.
CREWD.07	Lighting for the reinstated depot building shall be provided as existing and shall only be for operational and safety reasons.

Reference	Site-specific design principles
CREWD.08	Connections between the project works and the electrical and control equipment in the Lots Road Pumping Station shall be made underground.
CREWD.09	The design of the ventilation column to the valve and interception chambers shall make use of the existing concrete ventilation stack on the southeast corner of the Lots Road Pumping Station building. The connection into the stack shall be made underground and the ventilation stack shall be sympathetically modified or replaced to preserve and enhance the listed pumping station.
CREWD.10	Subject to the agreement of the landowner and the depot's operational requirements, bat roost features for common pipistrelle and soprano pipistrelle bats shall be installed on-site.
CREWD.11	Subject to the agreement of the landowner, nest boxes/ledges shall be installed in the replacement building to potentially attract a range of bird species, including the Black Redstarts and Grey Wagtails (an Amber List species).
CREWD.12	No boxes or ledges for birds/bats shall be attached or made within the existing Grade II listed pumping station.
CREWD.13	The site restoration shall minimise the amount of visual clutter and street furniture and provide a 4m clear strip along the river frontage for the future provision of a Thames Path by others.

4.10 Chelsea Embankment Foreshore

Table 4.19 Generic site information

Site name: Chelsea Embankment Foreshore	
DCO Work No.	12
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.09
Heritage principles	HRTG.01, HRTG. 02 and HRTG.08
Riparian and in-river structure principles	IRVR.06 and IRVR.12
Landscape design principles	LSCP.15
Lighting design principles	LTNG.06
Site drainage principles	SDRN.03 and SDRN.04

Table 4.20 Chelsea Embankment Foreshore draft site-specific design principles

Reference	Site-specific design principles
CHEEF.01	The new river wall and parapet materials shall match the stone and brick of the existing wall.
CHEEF.02	The foreshore structure shall incorporate terraces that provide either inter-tidal habitat or floodable public realm which incorporates planting. The design shall aim to minimise maintenance requirements and the risks of litter accumulation.
CHEEF.03	The landscape design shall replace the trees removed along the Embankment with the same number of semi-mature London Planes along the Embankment or in the Bull Ring. A gap in the line of the existing London Plane trees shall be retained as part of the landscape scheme to facilitate views between the river and Royal Hospital Chelsea.
CHEEF.04	The design shall discourage use of the foreshore structure as a bus/coach drop off.
CHEEF.05	The proposed signature design ventilation columns, electrical and control kiosks, and trees shall be located away from the axis of Monument Walk to enable views along Monument Walk to and from the river, as well as to and from the Royal Hospital.
CHEEF.06	The carriageway and ‘roundabout’ between the Bull Ring gates and the Chelsea Embankment (A3212) shall be repaved to match the new foreshore structure in natural stone without compromising the safe operation of the red route and bus turning. To the north of the Bull Ring, the existing bollards shall be retained in position and new paving to the footway shall match the existing.

Reference	Site-specific design principles
CHEEF.07	The existing pedestrian crossing (refuge) to the east of the Bull Ring gates shall be relocated further east as part of the overall landscaping scheme and shall provide the same facilities as existing.
CHEEF.08	The landscape design shall minimise the amount of visual clutter and street furniture.
CHEEF.09	Timber fenders shall not be provided as they are inappropriate to the character of this stretch of the river wall.
CHEEF.10	The existing parish boundary marker shall be reinstated on the new river wall.
CHEEF.11	No railings shall be provided on top of the new river wall parapet around the axis from the Royal Hospital, in order to ensure views between the river and the Royal Hospital are uninterrupted.
CHEEF.12	Interpretive historical material and information that references the lost river (Westbourne) shall be carefully designed and integrated into the site, and agreed with the local authority.
CHEEF.13	The landscape works around and above the low level sewer connection shall be graded to blend in with existing levels.
CHEEF.14	The boundary treatment of Ranelagh Gardens shall include a gate for utility company maintenance access. The new wall, railings and gate shall be designed to match the existing walls and railings.
CHEEF.15	The design and provision of any seating shall discourage rough sleepers.
CHEEF.16	Pre-established planting shall be used in the terraces.
CHEEF.17	The signature design ventilation columns shall not be flood lit.
CHEEF.18	The kiosks shall be integrated into the design of the new river wall parapet, in order to minimise visual clutter on the site.

4.11 Kirtling Street

Table 4.21 Generic site information

Site name: Kirtling Street	
DCO Work No.	13
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.02, FNCC.03, FNCC.07 to FNCC.09
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	LSCP.04 and LSCP.07
Lighting design principles	LTNG.02 and LTNG.03
Site drainage principles	SDRN.02, SDRN.03, SDRN.04 and SDRN.05.

4.11.1 Once the site is operational, Thames Water shall return it to the current owner/operator of the wharf, who would reconfigure the site in accordance with their own planning permission. An agreement with the owner/operator would ensure that Thames Water shall have access to the shaft, covers and above-ground structures at all times.

4.11.1 It is assumed that streetscape improvements would be provided by others in accordance with the Mayor of London's *Vauxhall/Nine Elms/Battersea Opportunity Area Planning Framework* public realm strategy for the area. Therefore, interim street surfacing and lighting would be provided and agreed with the local authority.

Table 4.22 Kirtling Street site-specific design principles

Reference	Site-specific design principles
KRTST.01	No operational lighting shall be provided, except for the concrete batching plant and a low level light to the electrical and control kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall only be activated by a directional motion control switch, linked to the door opening.
KRTST.02	No landscape works shall be undertaken except for new tree planting on Kirtling and Cringle Streets (subject to the agreement of the highway authority) and interim provision of signage for the Thames Path.
KRTST.03	The electrical and control kiosk and ventilation column shall be combined in a single structure. The signature design ventilation column shall not be used.
KRTST.04	The layout of the permanent works shall not compromise the viability of the future use of the site as a safeguarded wharf, in accordance with its designation by the Greater London Authority.

Reference	Site-specific design principles
KRTST.05	The final access arrangement and fence design for Kirtling Wharf shall be determined by the site owner and operator and agreed with Thames Water and the London Borough of Wandsworth.
KRTST.06	Maintenance vehicle access for Thames Water shall be from Kirtling Street.
KRTST.07	The materials and design of any reinstatement works outside of Kirtling Wharf shall be consistent with the Riverlight development in order to support a coherent public realm in the area.
KRTST.08	At the end of construction, Thames Water shall secure those parts of the site that are not public highway or concrete batching plant with high quality secure hoardings.
KRTST.09	The location of the permanent structures shall not compromise the future provision of a riverside Thames Path (by others).
KRTST.10	The combined ventilation and electrical and control kiosk structure shall preferably be located within the eastern zone identified on the Site works parameter plan in order to allow safe and unrestricted access for Thames Water maintenance and provide further flexibility for the sites future use.

4.12 Heathwall Pumping Station

Table 4.23 Generic site information

Site name: Heathwall Pumping Station	
DCO Work No.	14
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.02, FNCC.07, FNCC.08 and FNCC.09
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	None (ie, all principles apply)
Landscape design principles	None (ie, all principles apply)
Lighting design principles	LTNG.02 and LTNG.03
Site drainage principles	SDRN.03 and SDRN.04

Table 4.24 Heathwall Pumping Station site-specific design principles

Reference	Site-specific design principles
HEAPS.01	A new, publicly accessible riverside walkway shall be constructed between Middle Wharf and the Riverlight development for access to the foreshore structure. Provision shall be made for its closure during essential maintenance activities, and the operation of the safeguarded wharf if required. A diversion via Nine Elms Lane (along the route of the existing Thames Path) shall be clearly signposted when the riverside walkway is closed.
HEAPS.02	Safe and secure access shall be provided for future users of Middle Wharf across the riverside walkway and over the river wall to their jetty.
HEAPS.03	The riverside walkway shall be as wide as possible (minimum of 4m, if practicable) without compromising the operation of the safeguarded wharf and Thames Water activities, or without encroaching into the River Thames.
HEAPS.04	Materials and furniture in the public realm shall be in accordance with the public realm strategy in the *Vauxhall Nine Elms Battersea Opportunity Area Planning Framework* and shall coordinate with materials used in the adjacent St James Riverlight development.
HEAPS.05	Barbed wire shall be removed from the boundary and Pumping Station walls and replaced with a suitable and appropriate security measure, for compliance with Thames Water security requirements. The Pumping Station and boundary wall shall be cleaned and painted as necessary.
HEAPS.06	The treatment of the wall at the western end of the Middle Wharf site shall coordinate with that provided by the Riverlight developers.
HEAPS.07	The substation/office structure on Middle Wharf shall be retained.

Reference	Site-specific design principles
HEAPS.08	New trees shall be planted on Nine Elms Lane in accordance with the public realm strategy in the *Vauxhall Nine Elms Battersea Opportunity Area Planning Framework* and positioned to minimise disruption to existing utilities in the footway.
HEAPS.09	New lighting to the riverside walkway and foreshore structures shall be provided in accordance with the generic lighting principles. Luminaries shall be chosen to tie in with the Riverlight development.
HEAPS.10	High quality fencing shall be provided to the southern (back) edge of the riverside walkway. The fencing shall incorporate secure access gates to the pumping station and Middle Wharf. The fencing finishes shall tie in with the adjacent Riverlight development.

4.13 Albert Embankment Foreshore

Table 4.25 Generic site information

Site name: Albert Embankment Foreshore	
DCO Work No.	15
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.02, FNCC.09
Heritage principles	None (ie, all principles apply)
Riparian and in-river structure principles	IRVR.03 and IRVR.12
Landscape design principles	LSCP.15
Lighting design principles	None (ie, all principles apply)
Site drainage principles	SDRN.03 and SDRN.04

Table 4.26 Albert Embankment Foreshore site-specific design principles

Reference	Site-specific design principles
ALBEF.01	Access to Lack's Dock shall be retained for London Duck Tours Ltd and their security kiosk and vehicle barrier shall be reinstated in its existing location.
ALBEF.02	Any planting along Lack's Dock lost during construction shall be replaced.
ALBEF.03	The design shall respect the character and setting of the Grade II* listed Vauxhall bridge. In order to minimise effects on the setting of the bridge, the top of the interception structure (excluding vent columns) shall be below the springing point of the bridge arch.
ALBEF.04	Inter-tidal habitat shall be provided on the terraces around the interception structure. The design of the inter-tidal habitat and terraces shall be designed to: a. minimise the accumulation of litter b. use pre-established planting c. have minimum fixings into the listed bridge abutment d. have an attractive appearance in an un-vegetated state e. discourage access and climbing from the foreshore onto the top of the structure f. require minimal maintenance.
ALBEF.05	The interception structure and terraces shall be ‘bedded’ into the foreshore by rocks and boulders to provide habitat for fish species.

Reference	Site-specific design principles
ALBEF.06	Unless otherwise agreed there shall be no public access to the top of the interception structure. Level maintenance access shall be provided for Thames Water through the existing river wall via a secure gate from the Thames Path. The gate shall be the same height as the handrail on the existing river wall.
ALBEF.07	The new shaft structure shall be publicly accessible except during essential maintenance when it would be closed to the public.
ALBEF.08	The main electrical and control kiosk (interception structure) shall be located in the secure area below Vauxhall Bridge and shall not be attached to the listed bridge. A low level light shall be provided to the kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall be activated by a directional motion control switch, linked to the door opening.
ALBEF.09	Secure fencing to the area below the bridge shall be reinstated to match the existing like-for-like.
ALBEF.10	At the shaft location the public realm shall be elevated to the existing flood defence level to encourage views across the river to the Palace of Westminster World Heritage Site and Tate Britain.
ALBEF.11	In order to widen and improve the Thames Path, the area of existing Thames Path that passes below Camelford House shall be diverted over the new foreshore structure. The undercroft area shall be enclosed and shall not be publically accessible, subject to agreement with the landowner. The Thames Path shall be a minimum width of 4m across the new shaft structure.
ALBEF.12	The kiosk on the shaft structure shall be located in the proposed tree line.
ALBEF.13	Seating shall be positioned to maximise views of views of the Palace of Westminster World Heritage Site.
ALBEF.14	Three new semi-mature London Plane trees shall be planted on the shaft structure to separate the Thames Path from the seating area.
ALBEF.15	Removable bollards shall be provided along the northern edge of the entry to Lack’s Dock to allow vehicular access to the shaft structure for maintenance purposes. Vehicle access to the shaft structure in the foreshore shall also be via Lack's Dock. The landscape design shall include provision for a vehicle to turn around on the shaft structure.
ALBEF.16	Interpretive materials and information on the views and historic interest of the site shall be incorporated into the permanent works.

Reference	Site-specific design principles
ALBEF.17	Existing lighting on the Thames Path shall be reinstated as appropriate in accordance with the overall lighting design.
ALBEF.18	Existing paving in front of the Vauxhall Cross building shall be reinstated in accordance with the landscape scheme for the site.
ALBEF.19	The new river walls to the interception chamber and shaft structures shall be finished in high quality fair faced concrete.
ALBEF.20	Paving to the top of the interception structure shall be imaginatively designed to reference the lost river Effra and to be attractive when viewed from the bridge above.

4.14 Victoria Embankment Foreshore

Table 4.27 Generic site information

Site name: Victoria Embankment Foreshore	
DCO Work No.	16
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.04
Heritage principles	None (ie, all principles apply)
Riparian and in-river structure principles	IRVR.06
Landscape design principles	LSCP.15 and LSCP.16
Lighting design principles	None (ie, all principles apply)
Site drainage principles	SDRN.03 and SDRN.04

Table 4.28 Victoria Embankment Foreshore site-specific design principles

Reference	Site-specific design principles
VCTEF.01	The new river wall shall be finished in granite blocks to tie in with the existing wall.
VCTEF.02	Replacement trees planted on the embankment shall be semi-mature London Planes. Additional trees shall be planted on the structure to provide shade and improve the microclimate.
VCTEF.03	The sturgeon lamp standards shall be reinstated in their current position except where the permanent structure is located in which case their re-use would be agreed with the local authority.
VCTEF.04	The listed (sphinx) benches on the Victoria Embankment shall be reinstated and repositioned to either side of the new foreshore structure. If this is not possible, their re-use would be agreed with the local authority.
VCTEF.05	The proposed seating shall be positioned to maximise views over the river towards the Palace of Westminster World Heritage Site.
VCTEF.06	The coach parking on Victoria Embankment shall be reinstated where practicable.
VCTEF.07	The festoon lighting on Victoria Embankment shall be reinstated as far as possible and terminate either side of the structure. New lighting shall be designed in consultation with local authority and English Heritage.
VCTEF.08	The electrical and control kiosk(s) and small amenity buildings (to be operated by others) shall be located on the line of the existing river wall.
VCTEF.09	The kiosks shall be clad in natural stone that is appropriate to the setting and include a planted roof.

Reference	Site-specific design principles
VCTEF.10	Both junctions with the existing river wall shall be marked with a shadow gap, designed to limit the accumulation of litter.
VCTEF.11	Paving materials shall be of natural stone appropriate to the setting.
VCTEF.12	The central part of the public realm shall be raised to flood defence level to create viewing platforms towards the Palace of Westminster World Heritage Site.
VCTEF.13	The railing proposed for the front projecting area shall be designed to be visually unobtrusive and would be unglazed.
VCTEF.14	Any public furniture, fencing or railings shall be robust, durable and in keeping with the character of the surrounding townscape.
VCTEF.15	The design of the public realm shall be in accordance with guidance in Westminster Council's *Westminster Way - Public Realm Strategy, Design Practice and Principles* and *Trees and the Public Realm - A Tree Strategy for Westminster*, where practicable and unless otherwise agreed with the City Council.
VCTEF.16	The eastern (front projecting area) part of the structure shall be designed to step down to below the flood defence level to create an area of public realm which is occasionally flooded at the highest tides. The steps shall be broad to provide informal seating. The design shall provide a safe means of escape when the lower steps are flooded by the tide. Due to space constraints and the design intent to reflect existing projections in the listed river wall, step free access to this area is not possible.

4.15 Blackfriars Bridge Foreshore

Table 4.29 Generic site information

Site name: Blackfriars Bridge Foreshore	
DCO Work No.	17
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.04
Heritage principles	None (ie, all principles apply)
Riparian and in-river structure principles	IRVR.06
Landscape design principles	LSCP.16
Lighting design principles	None (ie, all principles apply)
Site drainage principles	SDRN.03 and SDRN.04

Table 4.30 Blackfriars Bridge Foreshore site-specific design principles

Reference	Site-specific design principles
BLABF.01	A lift shall be provided between the Thames Path and Blackfriars Bridge to facilitate step free access between Blackfriars Millennium Pier and Blackfriars Station.
BLABF.02	The Thames Path shall be diverted over the new foreshore structure. It shall be level and a minimum width of 4m. The Thames Path east of the Fleet Main CSO shall be a minimum width of 3m.
BLABF.03	Access ramps for the President moorings shall be designed to current standards. They shall bridge over the river wall with minimum physical or visual impact on the listed structure or span from the elevated platform at the western end of the new foreshore structure.
BLABF.04	The coach parking on Victoria Embankment shall be reinstated where practicable.
BLABF.05	The festoon lighting to Victoria Embankment shall be reinstated as far as possible.
BLABF.06	The WCs below the ramp shall be returned to use with new separate entrances.
BLABF.07	The majority of electrical and control equipment shall be located in the undercroft area. A smaller kiosk shall be located closer to the shaft within the line of the existing river wall for equipment that must be located close to the shaft.
BLABF.08	Voids below the ramp (both existing and proposed) shall be enclosed with high quality screens designed to be in keeping with the overall architectural and landscape design. Entrances to the main electrical and control equipment kiosk, WCs and specialist sports facility shall be integrated into this screen.

Reference	Site-specific design principles
BLABF.09	Services shall be provided to the undercroft areas to facilitate possible future commercial development (by others).
BLABF.10	The handrail that runs from the western Blackfriars Bridge parapet to the off-ramp from Blackfriars Bridge to Victoria Embankment shall be replaced to tie in with the new development. The fascia of the concrete edge beam shall also be re-clad.
BLABF.11	The western end of the foreshore structure shall be raised above the current flood defence level to create a viewing platform.
BLABF.12	The proposed railings to the western end of the foreshore area shall be designed to be as visually unobtrusive as possible without compromising safety.
BLABF.13	An amenity building (to be operated by others) shall be provided at the western end of the foreshore structure to help animate the space.
BLABF.14	The existing listed sturgeon lamp standards shall be carefully removed, stored and reinstated in their current position as far as possible.
BLABF.15	Trees planted on the Victoria Embankment shall be semi-mature London Planes.
BLABF.16	The landscape design shall seek to educate and encourage informal play and biodiversity. This may include: a. A water feature to visually interpret the challenges of surface water management, encourage play and improve the microclimate, subject to suitable maintenance arrangements b. planting to provide shade and improve the microclimate.
BLABF.17	The design shall respect the views from the river to the listed buildings along Victoria Embankment and St Paul’s Cathedral beyond.
BLABF.18	The foreshore structure walls shall be finished in natural stone.
BLABF.19	The Lion Heads along the river wall shall be incorporated into the design where possible.
BLABF.20	The pump house shall be removed and not replaced.
BLABF.21	The inter-tidal platform below the bridge shall be inaccessible to the public.
BLABF.22	The existing break in the parapet wall of Blackfriars Road Bridge shall be used to accommodate replacement stairs and a new lift to the eastern side of the bridge. The western replacement stairs shall be positioned to end in the zone of modern additions to the bridge. Both shall be designed to respect the historic character and fabric of the bridge.

Reference	Site-specific design principles
BLABF.23	The junction at the western end of the foreshore structure with the listed wall shall be marked with a ‘shadow gap’ designed to limit the accumulation of litter.
BLABF.24	Paving materials for areas of public realm shall be of natural stone.
BLABF.25	Vertical timber fenders shall be included in the design of river walls in order to deflect vessels away from the structure.

4.16 Chambers Wharf

Table 4.31 Generic site information

Site name: Chambers Wharf	
DCO Work No.	19
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.02, FNCC.06 and FNCC.07
Heritage principles	All - No principles apply
Riparian and in-river structure principles	IRVR.01, IRVR.03, IRVR.04 and IRVR.06 to IRVR.13
Landscape design principles	LSCP.01 to LSCP.13, LSCP.15 and LSCP.16
Lighting design principles	All (ie, no principles apply)
Site drainage principles	All (ie, no principles apply)

4.16.1 The later phases of the approved mixed-use redevelopment and landscaping of the Chambers Wharf site, to be carried out by others, shall commence after the completion of the works on the site.

Table 4.32 Chambers Wharf site-specific design principles

Reference	Site-specific design principles
CHAWF.01	The electrical and control kiosk shall be clad in materials that reflect the future use of this part of the site as public realm.
CHAWF.02	The large access covers shall have temporary infill or be paved with materials provided by the developer to match proposals for the residential development.
CHAWF.03	The site shall not be publicly accessible until the residential development and associated landscaping by others is complete. In the interim, the site shall be left secured against public access but shall allow safe access for maintenance by Thames Water.
CHAWF.04	No lighting shall be provided, except a low level light to the electrical and control kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall only be activated by a directional motion control switch, linked to the door opening.
CHAWF.05	Permanent handrail/guardings to the river wall shall be provided by the residential developer. Thames Water shall provide a temporary guarding to the new river wall around the maintenance area only to ensure the safety of Thames Water personnel.

Reference	Site-specific design principles
CHAWF.06	The ventilation columns and electrical and control kiosk shall be positioned to minimise the impact on the residential development and circulation within the new public realm and Thames Path (to be provided by the residential developer). The electrical and control kiosk shall be located no closer than 0.8m from the boundary wall of properties in Fountain Green Square.
CHAWF.07	In the event that the approved residential development for the site does not proceed immediately after construction of the operational structures and as an interim stage prior to the construction of the approved residential development, drainage of the permanent works, comprising the footprint of the raised ground level around the above ground structures and top of the shaft and access into site, shall comply with the National Standards for Sustainable Drainage Systems under the Floods and Water Management Act 2010. Drainage of the interim footprint of works shall be designed to drain rain water and so protect the operational structures.

4.17 King Edward Memorial Park Foreshore

Table 4.33 Generic site information

Site name: King Edward Memorial Park Foreshore	
DCO Work No.	24
Generic design principles	**Principles that do not apply**
Integration of functional components	None (ie, all principles apply)
Heritage principles	HRTH.01, HRTH.02, HRTH.04 and HRTH.06
Riparian and in-river structure principles	None (ie, all principles apply)
Landscape design principles	None (ie, all principles apply)
Lighting design principles	All (ie, no principles apply)
Site drainage principles	SDRN.04

4.17.1 Thames Water shall seek to work with the local authority and local stakeholders on the detailed design of the landscape scheme for the park.

4.17.2 The existing children's playground shall be permanently relocated prior to construction as shown on the landscape plan. It may be extended and modified as part of the permanent works or located in a different part of the park if agreed by the local authority.

4.17.3 Once the permanent access route for the project is open, the existing western end of the Thames Path may become redundant and may be removed in agreement with the local authority to be incorporated in an enhanced landscaping associated with the new section of the Thames Path.

Table 4.34 King Edward Memorial Park Foreshore site-specific design principles

Reference	Site-specific design principles
KEMPF.01	The electrical and control kiosk shall be located no closer than 0.8m from the eastern boundary wall, to avoid interrupting views from the park to the river, and be designed so as not to provide a means of scaling the boundary wall into the adjacent residential development.
KEMPF.02	The permanent access route to the site shall be fully integrated with the landscaping proposals for the park, as part of a new area of public realm and a potential new alignment of a widened Thames Path. It shall be publicly accessible to pedestrians and cyclists only during park opening hours. The entrance at Glamis Road shall be gated when the park is closed.
KEMPF.03	The memorial benches and bandstand shall be reinstated within the park as shown on the Landscape Plan, unless otherwise agreed with the local authority.

Reference	Site-specific design principles
KEMPF.04	The sports pitches shall be reconfigured to accommodate the proposed access arrangements prior to the start of construction.
KEMPF.05	Circulation onto and around the foreshore structure shall be clear and legible and integrated as far as possible with circulation around the park and along the Thames Path.
KEMPF.06	The design shall reinforce the character of the park, specifically by planting large tree species close to the river frontage wherever possible. Existing paths and landscaped areas shall be extended onto the foreshore structure where practicable, in order to integrate it into the surroundings.
KEMPF.07	The park is closed at night, therefore no permanent lighting shall be provided except for a low level light to the kiosk doors to allow access for emergency maintenance purposes in the hours of darkness. This light shall only be activated by a switch, linked to the door opening.
KEMPF.08	The design of the river walls shall not compromise the safety of recreational boat users and shall not incorporate overhangs unless these are adequately fendered.
KEMPF.09	Bird boxes shall be installed on trees to attract a range of bird species.
KEMPF.10	Bat boxes shall be installed on trees to attract species such as common pipistrelle and noctule bats.
KEMPF.11	The proposed permanent access shall be designed to facilitate improved views of the Rotherhithe tunnel ventilation shaft which at the present is not visible from the western end of the Thames Path.

4.18 Earl Pumping Station

Table 4.35 Generic site information

Site name: Earl Pumping Station	
DCO Work No.	21
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.04 and FNCC.06
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	LSCP.01 to LSCP.10, and LSCP.16
Lighting design principles	LTNG.02, LTNG.03, LTNG.05, LTNG.06 and LTNG.08 to LTNG.10
Site drainage principles	SDRN.02, SDRN.03 and SDRN.05

Table 4.36 Earl Pumping Station site-specific design principles

Reference	Site-specific design principles
EARPS.01	Following construction, high quality secure hoardings shall be left temporarily in place on the part of the site that is not required permanently.
EARPS.02	For hydraulic reasons, the design shall incorporate the raised level required for the shaft structure.
EARPS.03	The existing pumping station compound wall shall be reinstated in its current position. Additional gates shall be provided to access the shaft.
EARPS.04	A high quality, low-maintenance planted brown roof shall be provided on top of the shaft. The roof shall be visually attractive when viewed from above.
EARPS.05	The shaft enclosure shall provide visual interest when viewed from the surrounding streetscape and from above.
EARPS.06	The valve chamber shall incorporate a low-maintenance brown roof.
EARPS.07	Access to the roof of the shaft structure shall be provided within the Thames Water compound. The roof of the shaft structure shall not be publicly accessible.
EARPS.08	The design shall not compromise the existing operation of the Thames Water pumping station.
EARPS.09	Lighting shall be provided to the staircase and shaft surface for maintenance activities only.

4.19 Deptford Church Street

Table 4.37 Generic site information

Site name: Deptford Church Street	
DCO Work No.	22
Generic design principles	**Principles that do not apply**
Integration of functional components	None - All principles apply
Heritage principles	HRTG.02 to HRTG.04 and HRTG.06 to HRTG.08
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	LSCP.15 and LSCP.16
Lighting design principles	All (ie, no principles apply)
Site drainage principles	SDRN.02, SDRN.04 and SDRN.05

4.19.1 Thames Water shall work with the local authority and local stakeholders on the detailed design of the landscaping scheme.

Table 4.38 Deptford Church Street site-specific design principles

Reference	Site-specific design principles
DEPCS.01	The design shall facilitate pedestrian movements around the site identified in the local authority's *North Lewisham Links Strategy 2007*.
DEPCS.02	The car parking spaces on Coffey Street shall be reinstated unless otherwise agreed with the local authority.
DEPCS.03	Adequate space for the school fire and emergency mustering point shall be re-provided.
DEPCS.04	Access points for Thames Water maintenance vehicles shall be provided on Coffey Street and Crossfield Street to create a through route across the site. When not in use for maintenance purposes, the route shall only be accessible to pedestrians and cyclists.
DEPCS.05	The amount of hardstanding within the site boundary shall be minimised as far as possible.
DEPCS.06	The design shall create a more integrated and accessible public space to enhance the setting of the listed church.
DEPCS.07	No new lighting to the park shall be provided except for a low level light to the kiosk doors to allow access for maintenance purposes in the hours of darkness. This light shall only be activated by the door opening. Street lighting shall be reinstated.
DEPCS.08	Bird boxes shall be installed on the trees to attract a range of bird species following completion of the construction works.

Reference	Site-specific design principles
DEPCS.09	The landscaping of the open space following completion of the construction works shall include reinstatement of a species-rich amenity grassland mix and include the fiddle dock species.

4.20 Greenwich Pumping Station

Table 4.39 Generic site information

Site name: Greenwich Pumping Station	
DCO Work No.	23
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.02 to FNCC.04 and FNCC.07, to FNCC.09
Heritage principles	HRTG.07and HRTG.08
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	LSCP.16
Lighting design principles	LTNG.06 and LTNG.09
Site drainage principles	SDRN.03 and SDRN.04

4.20.1 There are no acoustic requirements for the envelope of the Beam Engine House. Noise shall be reduced at the source.

Table 4.40 Greenwich Pumping Station site-specific design principles

Reference	Site-specific design principles
GREPS.01	Following completion of the works, high quality secure hoardings shall be left in place on the Phoenix Wharf part of the site until it is handed over to others for redevelopment.
GREPS.02	The footpath, including lighting, shall be reinstated as existing, unless otherwise agreed by the local authority. Land between the DLR and Network Rail viaducts shall be left in a condition that would not preclude any potential future enhancement of public realm in this area.
GREPS.03	For hydraulic reasons, the design shall accommodate the raised level required for the shaft structure. It shall fit with the overall architectural and landscape design for the site. The shaft shall feature a low-maintenance brown roof with integrated covers.
GREPS.04	Any York stone slabs removed by construction works shall be re-used for the roof of the new interception chamber. If this is not possible, the chamber shall be finished in fair-faced concrete consistent with its functional nature and context.
GREPS.05	Access for Thames Water maintenance vehicles shall be via Norman Road. Modifications to the existing gates and wall shall be in character with the existing.
GREPS.06	Fencing or railings shall be robust, durable and in keeping with the context.
GREPS.07	The area within the site that is not required for access shall be planted with low-maintenance wild flowers and grassland.

Reference	Site-specific design principles
GREPS.08	Security arrangements within the site, such as new or altered fence lines, shall be in accordance with Thames Water policy.
GREPS.09	The existing glazing of the East Beam Engine House shall be renovated or replaced as required. Any alterations to the glazing to facilitate the reuse of the building shall be sensitive to the building's significance.
GREPS.10	No new lighting shall be provided except for low level lighting to the steps to the shaft, which shall only be used during maintenance activities.
GREPS.11	Trees removed to improve access to the construction site shall be replaced elsewhere on the site.

4.21 Abbey Mills Pumping Station

Table 4.41 Generic site information

Site name: Abbey Mills Pumping Station	
DCO Work No.	26
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.03, FNCC.04 and FNCC.9
Heritage principles	HRTG.01 to HRTG.03 and HRTG.06, to HRTG.08
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	All (ie, no principles apply)
Lighting design principles	All (ie, no principles apply)
Site drainage principles	SDRN.03 and SDRN.04

4.21.1 The project works would be located within an existing Thames Water operational site.

Table 4.42 Abbey Mills Pumping Station site-specific design principles

Reference	Site-specific design principles
ABMPS.01	The layout of the permanent works shall coordinate with the permanent works associated with the Lee Tunnel project.
ABMPS.02	The design of the ventilation outlets shall be in keeping with the context. The signature design ventilation column shall not be used.
ABMPS.03	Planting and fence treatments to the boundary, outside of the project site, shall be completed as part of the Lee Tunnel project. Any landscaping disrupted during construction shall be reinstated. No additional landscaping is proposed for the project works.
ABMPS.04	The fenced enclosure around the Lee Tunnel shaft shall be extended to encompass the project works.
ABMPS.05	Materials shall be robust and comply with Thames Water requirements.
ABMPS.06	A minimum of ten bat boxes shall be installed on trees adjacent to the site following completion of the construction works.
ABMPS.07	Bird boxes shall be installed on the trees adjacent to the site to attract a range of bird species including kestrel and pied wagtail, following the completion of the construction works.

4.22 Beckton Sewage Treatment Works

Table 4.43 Generic site information

Site name: Beckton Sewage Treatment Works	
DCO Work No.	27
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.03 to FNCC.06, FNCC.08 and FNCC.09
Heritage principles	HRTG.01 to HRTG.03, HRTG.06 to HRTG.08
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	All (ie, no principles apply)
Lighting design principles	All (ie, no principles apply)
Site drainage principles	All (ie, no principles apply)

4.22.1 The project works would be located within an existing Thames Water operational site.

Table 4.44 Beckton Sewage Treatment Works site-specific design principles

Reference	Site-specific design principles
BESTW.01	The site layout shall coordinate with the Lee Tunnel project and the permanent works of the sewage treatment works upgrade.
BESTW.02	The design of the ventilation outlets shall be in keeping with the context. The signature design ventilation column shall not be used.
BESTW.03	Materials shall be robust and comply with Thames Water standard requirements.
BESTW.04	Barn owl nest sites created during construction shall be retained and maintained during operation.

4.23 Shad Thames Pumping Station

Table 4.45 Generic site information

Site name: Shad Thames Pumping Station	
DCO Work No.	18
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.01 to FNCC.04, FNCC.06 to FNCC.09
Heritage principles	HRTG.01, HRTG.02 and HRTG.06 to HRTG.08
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	All (ie, no principles apply)
Lighting design principles	All (ie, no principles apply)
Site drainage principles	All (ie, no principles apply)

4.23.1 The purpose of the new annex is to house electrical and control equipment. Access shall be required infrequently in order to inspect and maintain the equipment.

Table 4.46 Shad Thames Pumping Station site-specific design principles

Reference	Site-specific design principles
SHTPS.01	The new annex shall be no higher than the former building.
SHTPS.02	The materials used shall be low-maintenance and durable. They shall preserve or enhance the character of the conservation area and the setting of the listed Wheat Wharf.
SHTPS.03	Glass on the northeast elevation shall be minimised or permanently obscured and windows shall be fixed shut so that it is not possible to look directly into rooms and balconies on Wheat Wharf.
SHTPS.04	The ventilation column for the pumping station shall be relocated as far from existing residential windows as possible, to minimise impacts on residential amenity.
SHTPS.05	No brown roof shall be provided on the new building.
SHTPS.06	The main pedestrian access to the annex shall be via the alley way at the northeastern end of the building.
SHTPS.07	Vehicular access shall be via Maguire Street only.
SHTPS.08	Site drainage shall be reinstated as existing.

4.24 Bekesbourne Street

Table 4.47 Generic site information

Site name: Bekesbourne Street	
DCO Work No.	25
Generic design principles	**Principles that do not apply**
Integration of functional components	FNCC.01 to FNCC.04, FNCC.06 and FNCC.09
Heritage principles	All (ie, no principles apply)
Riparian and in-river structure principles	All (ie, no principles apply)
Landscape design principles	All (ie, no principles apply)
Lighting design principles	All (ie, no principles apply)
Site drainage principles	All (ie, no principles apply)

Table 4.48 Bekesbourne Street site-specific design principles

Reference	Site-specific design principles
BEKST.01	The paving treatment around the landscaping works on Bekesbourne Street shall be reinstated as existing.
BEKST.02	Site drainage shall be reinstated as existing.
BEKST.03	An additional tree shall be planted in the empty tree pit on Bekesbourne Street.

Glossary

advanced tree planting	Trees planted before the main construction activities commence.
air management structures	Collective term for ventilation equipment.
biodiversity	Biological diversity – or 'biodiversity' – is the term given to the variety of plant and animal species in a given environment and the natural patterns they form.
brown roof	A roof that supports a wide variety of plant and animal species and reduces storm water run-off.
Code of construction practice (CoCP)	A document that sets out control measures to be adopted during the construction period.
combined sewer overflow (CSO)	A structure, or series of structures, that allows sewers that carry both rainwater and wastewater to overflow into a river when at capacity during periods of heavy rainfall. The flows are discharged to river in order to prevent the sewers backing up and flooding streets or houses. Flows may discharge by gravity or by pumping.
connection culvert	A covered channel structure to connect the interception chamber to the drop shaft.
connection tunnel	A tunnel that connects a drop shaft to the main tunnel.
drop shaft	A circular, vertical concrete structure to drop flows from a CSO to a main tunnel.
electrical and control kiosk	A structure that houses electrical and control equipment.
heritage asset	A building, monument, site, place, area or landscape positively identified as having a degree of significance that merits consideration in planning decisions. Heritage assets are the valued components of the historic environment. They include designated heritage assets and assets identified by the local planning authority (including local listing).
historic environment	Above-ground and buried heritage assets that are considered to be significant because of their historic, archaeological, architectural or artistic interest. They might comprise below and above-ground archaeological remains, buildings, structures, monuments or heritage landscapes within or immediately around proposed development sites.
impact	A physical or measurable change to the environment that is attributable to the project.
interception chamber	A structure constructed around an existing combined sewer

	that diverts storm water from the sewer into a new system of structures to transfer storm water flow to a sewage treatment works.
open space	All space of public value, including landscaped public areas, playing fields, parks and play areas as well as areas of water such as rivers, canals, lakes and reservoirs that offer opportunities for sport and recreation or provide visual amenity.
operational phase	Once construction work is complete and the tunnel system is in use.
penstock	A gate used to control wastewater flow
public open space	Urban space designated by a local development framework where public access may or may not be formally established that fulfils or may fulfil a recreational or non- recreational role.
public realm	Any publicly-owned area, including streets, pathways, parks, publicly accessible open spaces, and public and civic facilities.
Public Right of Way	Route to which the public has right of access.
pumping station	A vertical structure with pumps used to lift water up to a higher level.
reinforced grass	An area of grass reinforced with a mesh to improve load bearing capacity and wear resistance.
run-off	Run-off is the movement of rain water over land. Run-off consists of precipitation that does not evaporate, transpire or penetrate the surface to become groundwater. Excess run-off can lead to flooding, which occurs when there is too much precipitation.
safeguarded wharf	A wharf that is protected by the Mayor of London and the Port of London Authority, to ensure that it is retained as a working wharf and protected from redevelopment into other uses.
scour	Movement of riverbed materials due to the force of the water.
screens	As part of the wastewater treatment process, screens are used to physically remove larger objects, including floating debris, from the incoming flow to ensure that sewage is amenable to treatment.
sewage or wastewater	Water-borne wastes from domestic uses of water, derived from households, trade and industry.
signature ventilation column	The project's own specially designed ventilation column (a vent column is a vertical pipe through which air is released).

slipway	A sloping surface leading down to a body of water from which boats may be launched.
specimen trees	Specially selected large trees with a height over 7m and a girth over 50cm when planted.
temporary works	Works required to facilitate construction, including any works left in place after completion (eg, temporary steel piles that do not need to be removed).
Thames Path	A designated footpath that follows the route of the River Thames.
valve chamber	An underground structure on the sewer system that contains valves used to isolate the flow between different parts of the sewerage system. For example, flap valves prevent flow from the river travelling back up the sewer or into tunnels.
ventilation building	A building that contains fans and filters to remove and treat air from the tunnel.
ventilation column	A vertical pipe through which air is released.
ventilation duct	Pipework (generally below ground) through which air moves.
ventilation structure	An above-ground or below-ground structure that is part of the tunnel ventilation system.
venturi	A constricted section of pipe designed to reduce pressure when a fluid flows through it.
wastewater or sewage	Water-borne wastes from domestic uses of water, derived from households, trade and industry.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.01**

Volume 1: Introduction to the Environmental Statement

Appendix C: Compensation Programme

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

Box **15** Folder **A**
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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Appendix C: Compensation programme

Please refer to separate stand-alone documents

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