Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

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Environmental Statement: Non-Technical Summary

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Non-technical summary

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1 Introduction

1.1 About this document

1.1.1 This document is the non-technical summary of the *Environmental Statement* prepared by Thames Water Utilities Limited (Thames Water), as part of the application for development consent for the Thames Tideway Tunnel (the project).

1.1.2 Thames Water is the UK's largest water and wastewater services company, serving about 13 million customers in London and the South East of England. It has a statutory duty under the Water Industry Act 1991 to provide and improve a system of public sewers.

1.1.3 Thames Water is seeking authority to construct and operate the Thames Tideway Tunnel. An environmental impact assessment has been undertaken in accordance with the *Infrastructure Planning* (*Environmental Impact Assessment*) *Regulations 2009* to predict the impact of the project on the environment. The findings of the assessment are reported and explained in the *Environmental Statement*, which is available on the Thames Tideway Tunnel website (http://www.thamestunnelconsultation.co.uk/). This website also identifies the location of where hard copies of the *Environmental Statement* may be viewed.

1.1.4 The purpose of this non-technical summary is to summarise the content and main findings of the *Environmental Statement* in a clear and concise manner. As a major infrastructure project which stretches approximately 25km across 14 local planning authorities, the *Environmental Statement* for the Thames Tideway Tunnel is a substantial 27 volume document. To ensure this non-technical summary provides a helpful and accessible account of the *Environmental Statement*, it has been necessary to focus on key information likely to be of general relevance. Throughout this non-technical summary, reference is made to the corresponding volume of the *Environmental Statement* where full details of the assessment can be found.

1.1.5 Section 2 gives a brief description of the project, with the main alternatives considered presented in Section 3. An explanation of how the assessment has been undertaken is given in Section 4. The remaining sections describe the likely significant effects on the environment predicted to arise across the entire project (Section 5) as well as at each of the individual 24 sites (Sections 6 – 29). A summary of significant effects on a topic by topic basis is given in Section 30.

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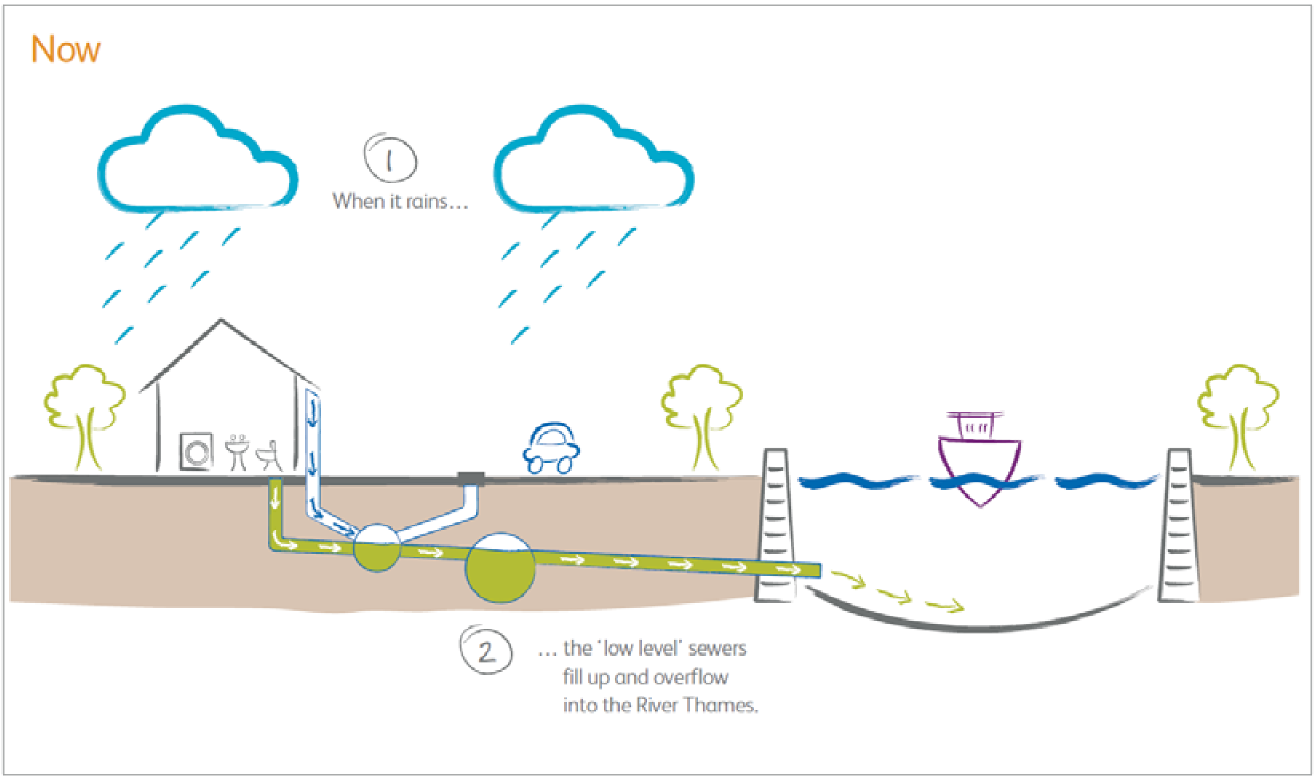
2 Thames Tideway Tunnel project

2.1 Background

2.1.1 London's sewer system was designed by Sir Joseph Bazalgette in the 1850s to handle wastewater and rainwater runoff by means of a combined collection system. In order to prevent the sewers from flooding when overloaded, particularly during periods of heavy rainfall, combined sewer overflows were incorporated to discharge excess flows from the sewers into the River Thames.

Figure 2.1 The existing situation



2.1.2 The capacity of the original and subsequently extended combined sewer system has now been substantially exceeded.

2.1.3 Discharges of combined sewage (untreated sewage mixed with rainwater) into the River Thames (Figure 2.2) currently occur on average once a week. Discharges must be reduced because it is unacceptable to pollute the Thames with large volumes of raw sewage and in order to comply with relevant wastewater legislation. The UK Government is required to meet the requirements of the *EU Urban Waste Water Treatment Directive* and the *EU Water Framework Directive*.

Figure 2.2 Upper, middle and lower sections of the River Thames

2.1.4 Solutions to the problem of wastewater discharges into the River Thames have been under examination for more than ten years. The Thames Tideway Tunnel project has been determined to be the most technologically sound and cost-effective means of controlling discharges and satisfying regulatory requirements.

2.1.5 Government policy, set out in the National Policy Statement for Waste Water (March 2012[1]), confirms the need for a Thames Tideway Tunnel, stating ‘it is the only option to address the problem of discharging

[1] The National Policy Statement for Waste Water (March 2012) can be found on this website: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf

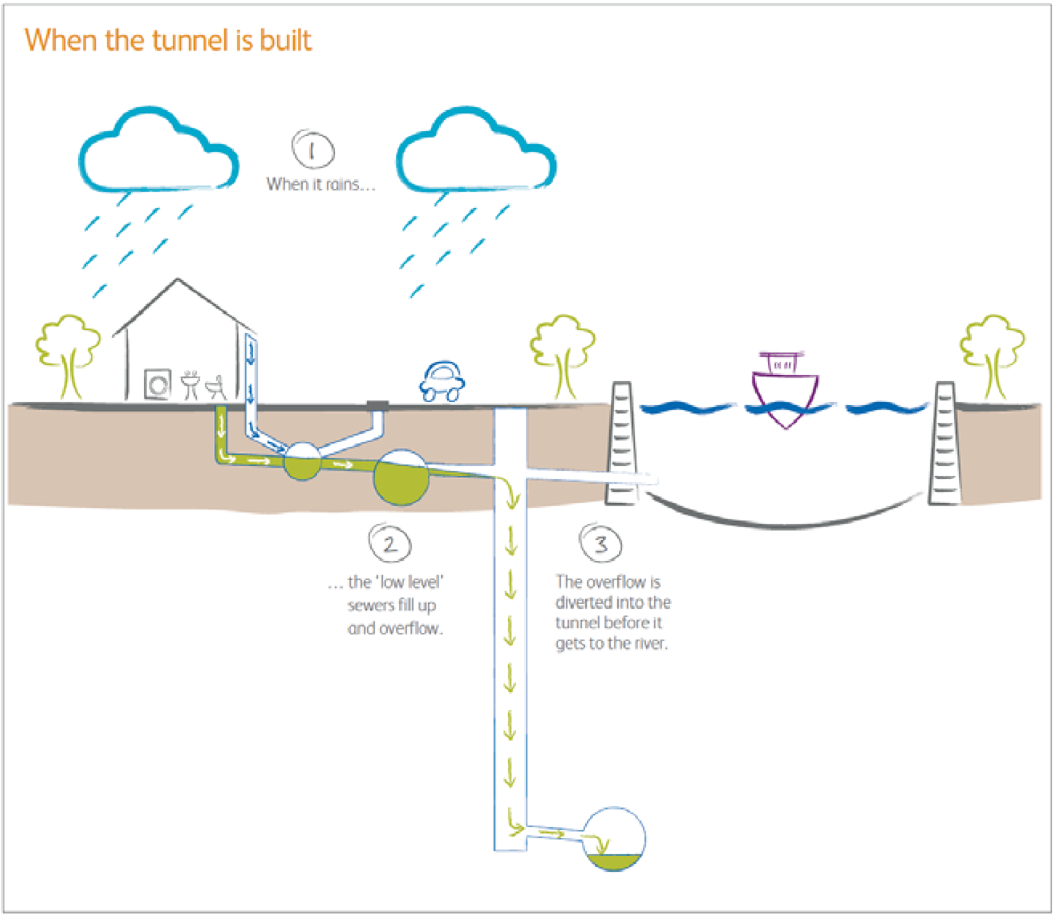
unacceptable levels of untreated sewage into the River Thames within a reasonable time and a reasonable cost.'

2.2 Proposed development

Overview

2.2.1 The purpose of the project is to capture and control discharges from the most polluting combined sewer overflows in order to meet EU and UK legislative requirements. A high proportion of the untreated combined sewage that currently flows directly into the River Thames from combined sewer overflows would be intercepted, captured and stored[2] in the main tunnel and other connection tunnels that form part of the Thames Tideway Tunnel (Figure 2.5). The connection tunnels would link intercepted combined sewer overflows to the main tunnel (Figure 2.3). The flows would then be transported via the Lee Tunnel to Beckton Sewage Treatment Works in east London.

Figure 2.3 When the project is built



2.2.2 The development proposal as set out in the application form for development consent is for the following:

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

The project comprises a wastewater storage and transfer tunnel (the 'main tunnel') between the operational Thames Water sites at Acton Storm Tanks and Abbey Mills Pumping Station. The project will control combined sewage flows from 34 combined sewer overflows (CSOs) identified as unsatisfactory by the Environment Agency. During and following storm events, when London's sewers are unable to handle extra wastewater flow, a series of interception structures will divert the flow into the tunnel system, where it will be stored and transferred to Abbey Mills Pumping Station, and then to Beckton Sewage Treatment Works via the Lee Tunnel.

The project comprises:

a. tunnels:

- one main tunnel, which will capture and store combined sewage from unsatisfactory CSOs along its route and transfer it to Abbey Mills Pumping Station, from where the Lee Tunnel will transport it for treatment at Beckton Sewage Treatment Works

- 11 connection tunnels, which will link flows from CSOs to the main tunnel

b. sites:

- five main tunnel sites

- 16 CSO sites

- two system modification sites

- works at Beckton Sewage Treatment Works.

Definitions:

Main tunnel sites: *main tunnel sites will be required to construct the main tunnel shafts and the main tunnel. They will be drive and/or reception sites.*

A main tunnel drive site will be used to construct the main tunnel shaft, install the tunnel boring machine (TBM) and then drive the TBM. Therefore the site will also deal with excavated material from the shaft and tunnel, all support facilities for the TBM and the primary lining of the main tunnel. It will also provide access for secondary lining installation.

A main tunnel reception site will be used to construct the main tunnel shaft and remove the TBM from the tunnel at the end of a drive. Therefore the site will deal with excavated material from the shaft and removal of the TBM. It will also provide access for installing secondary lining.

CSO sites: *CSO sites will be required to construct the CSO interception system of structures which typically include an interception chamber, valve chambers, ventilation structures, an electrical and* *control kiosk, a connection culvert, a CSO drop shaft containing a vortex drop shaft and a connection tunnel.*

System modification sites: *system modification sites will be required to construct alterations to the existing sewerage system to control CSO flows by means other than interception. The modifications will enable flows to pass through the existing sewer system to the treatment works without being connected to the main tunnel.*

2.2.3 It is anticipated that construction of the Thames Tideway Tunnel would commence in approximately 2016 and would take about six years to build. On this basis, the Thames Tideway Tunnel would be operational by 2023.

2.2.4 Plans of the proposed development are submitted for approval. Measures to be applied during construction are contained in a *Code of Construction Practice* which accompanies the application. This includes standards and procedures for managing construction site activities, environmental monitoring and a stakeholder communication strategy. Site-specific controls would also be put in place during the construction phase in response to the wide range of sites across the route of the main tunnel. *Design Principles* submitted with the application provide a framework for the finished design of sites. The information on which the assessment is based is appended to the *Environmental Statement*.

Main tunnel

2.2.5 The horizontal alignment of the main tunnel would generally follow the River Thames where possible and practical, because:

a. It is an efficient route to connect the combined sewer overflows, which are located on both the north and south banks of the river.

b. It would allow the use of the river for construction transport (material supply and removal), where practicable and economic.

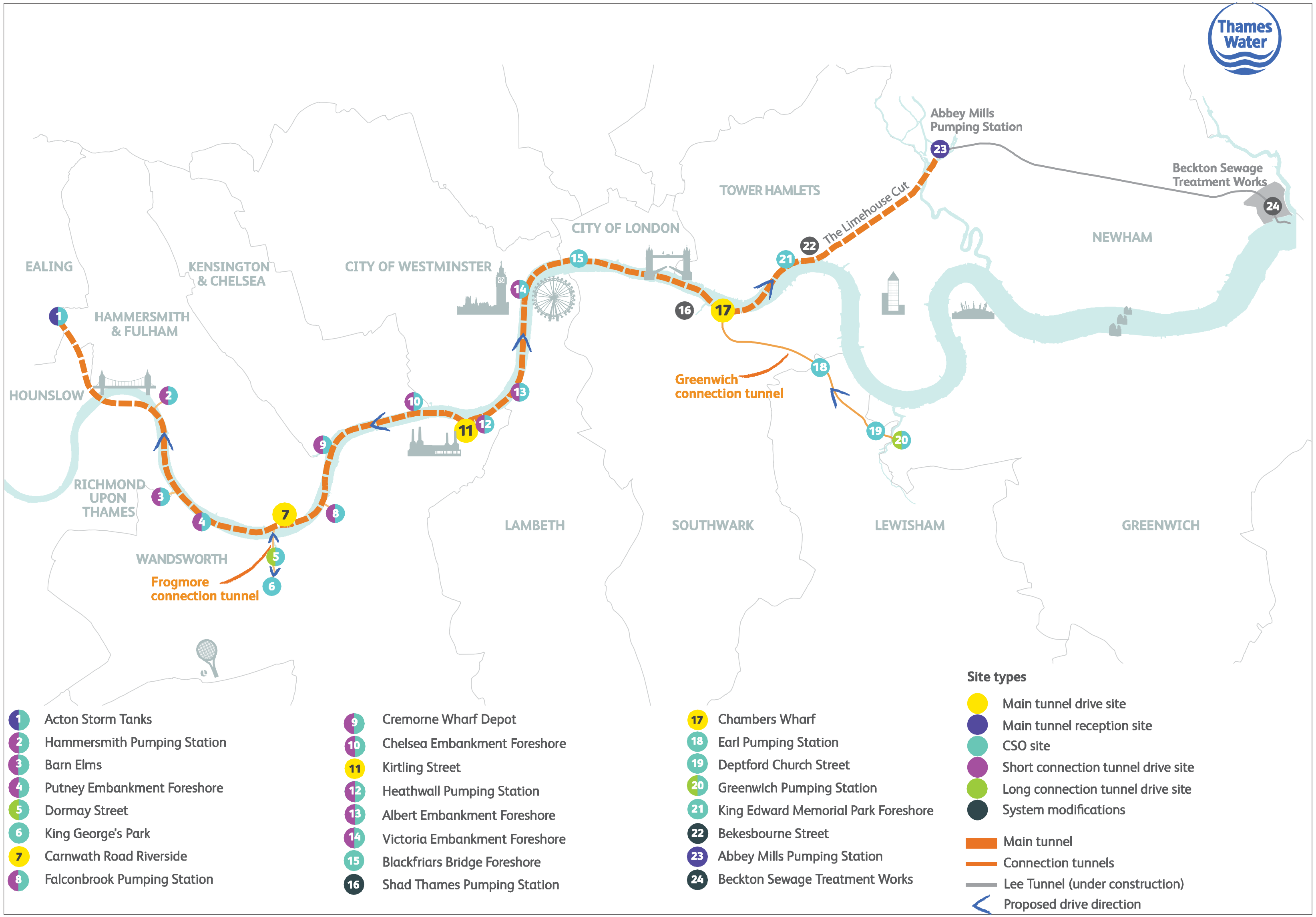
c. It would minimise the number of structures and properties the tunnel would pass beneath and so reduce the number of third parties affected.

2.2.6 The route of the main tunnel would take the shortest practical line from Acton Storm Tanks to the River Thames and stay mostly beneath the river from west London to Rotherhithe. It would then divert from beneath the River Thames to the northeast via the Limehouse Cut and terminate at Abbey Mills Pumping Station, where it would connect to the Lee Tunnel. The captured combined sewage would then be transferred to Beckton Sewage Treatment Works via the Lee Tunnel. The Lee Tunnel (which does not form part of the Thames Tideway Tunnel application) is currently under construction (Figure 2.4) and once complete will intercept flows at Abbey Mills. It is due to be operational by 2014.

Figure 2.4 Construction works for the Lee Tunnel

2.2.7 The main tunnel for the Thames Tideway Tunnel (Figure 2.5) would be approximately 25km long with an internal diameter of between 6.5 and 7.2m. The approximate depth of the tunnel would be between 30m in west London, dropping to 65m in east London in order to provide sufficient clearance to existing tunnels and facilities under the capital and allow eastward movement of the tunnel flows by gravity.

Figure 2.5 Project overview



2.2.8 Tunnelling would be a non-stop 24 hour activity. The material excavated from the main tunnel would be transported within the tunnel and removed at each of the three ‘drive sites’, namely Carnwath Road Riverside, Kirtling Street and Chambers Wharf. These sites can be seen in Figure 2.5. The excavated material would then be transported away by barge along the River Thames. The destination of the excavated material will be decided at a later stage. At this stage, there is a short list of suitable sites which are being considered. Alternative sites which may become available will also be considered so that the optimum site or sites are selected in due course.

Connection tunnels

2.2.9 Two long connection tunnels would be required in order to connect five intercepted combined sewer overflows to the main tunnel as the interception points are some distance away from the main tunnel. The tunnels are known as the Frogmore connection tunnel (approximately 2.6m in internal diameter and approximately 1.1km long), and the Greenwich connection tunnel (approximately 5m in internal diameter and approximately 4.6km long). These connection tunnels can be seen in Figure 2.5. The drive site for the Frogmore connection tunnel would be at Dormay Street and the drive site for the Greenwich connection tunnel would be Greenwich Pumping Station.

2.2.10 In addition to these two long connection tunnels, a series of short connection tunnels would also be required to connect many of the new shafts at the combined sewer overflow locations to the main tunnel.

Sites

Main tunnel sites

2.2.11 The main tunnel drive sites and reception sites are, from west to east, as follows:

Acton Storm Tanks (London Borough of Ealing) – reception site

a. The tunnel boring machine would be driven westwards from Carnwath Road Riverside and received at Acton Storm Tanks.

Carnwath Road Riverside (London Borough of Hammersmith and Fulham) – drive site and reception site

b. The tunnel boring machine would be driven westwards from this site to Acton Storm Tanks. In addition, Carnwath Road Riverside would also receive a tunnel boring machine, which would be driven west from Kirtling Street.

Kirtling Street (London Borough of Wandsworth) – double drive site

c. A tunnel boring machine would be driven westwards from this site towards the Carnwath Road Riverside site and another tunnel boring machine would be eastwards towards the Chambers Wharf site, at the same time, making this a double drive site.

Chambers Wharf (London Borough of Southwark) – drive site and reception site

d. The tunnel boring machine driven from Kirtling Street would be received at this site. In addition, Chambers Wharf would function as a drive site, with the tunnel boring machine driven eastwards towards the Abbey Mills Pumping Station site. It would also receive the tunnel boring machine driven from Greenwich Pumping Station and used to construct the long connection tunnel from Greenwich.

Abbey Mills Pumping Station site

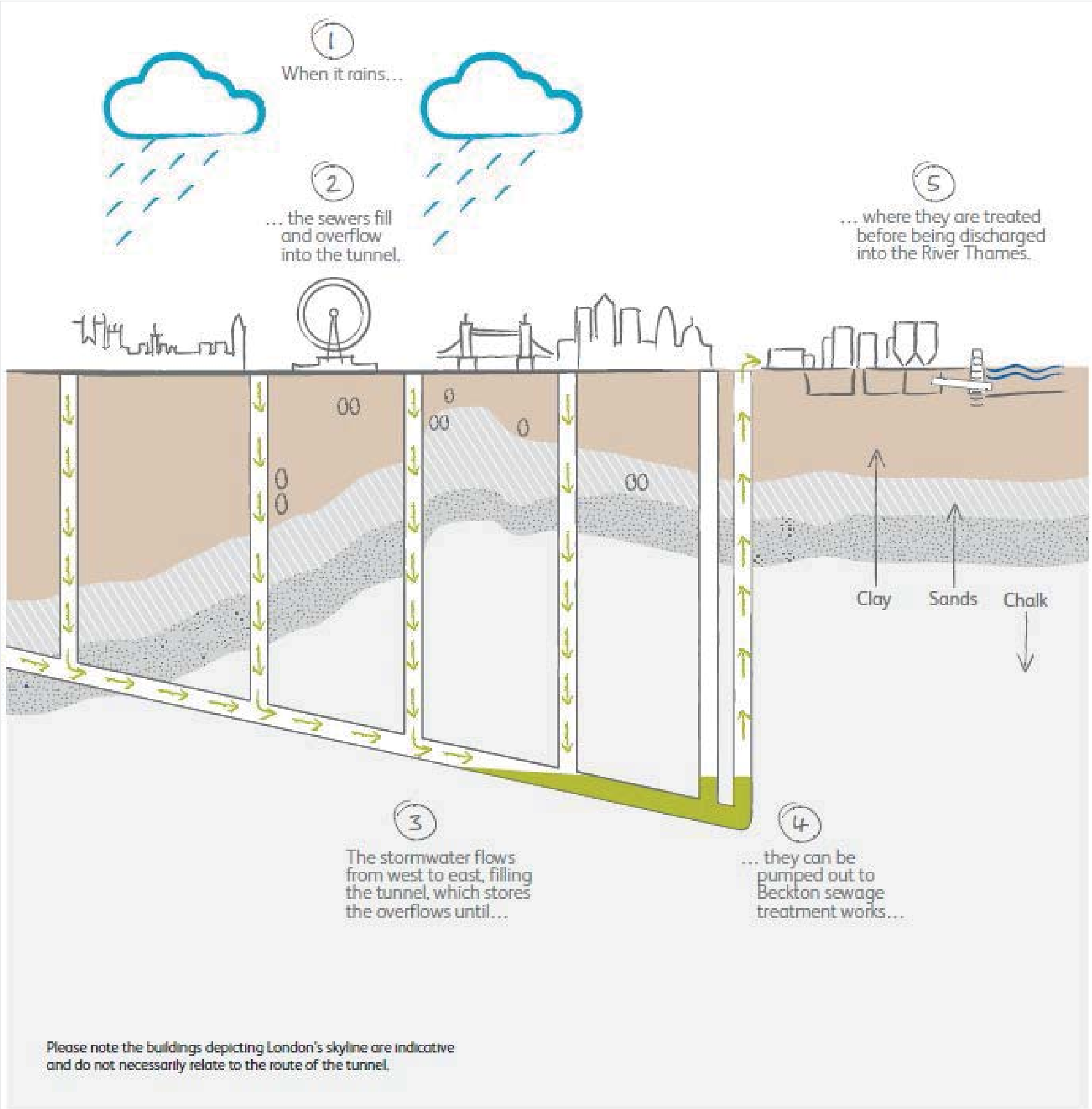
e. The tunnel boring machine driven from Chambers Wharf would be received at this site. A short section of main tunnel would also be built between the new shaft and the Lee Tunnel shaft.

Combined sewer overflow sites

2.2.12 Each combined sewer overflow site would temporarily accommodate the construction equipment and activities required to create the combined sewer overflow interception and control facilities. Once construction is complete, the sites would house the permanent structures described in paragraph 2.2.2. A means of access and space adjacent to the interception location and shafts for periodic inspection and maintenance would also be included.

2.2.13 As well as the proposed permanent structures, all construction sites would be restored on completion of the works by means of levelling, in-filling and landscaping as required.

Figure 2.6 Capturing the overflows



2.2.14 At the following sites, there would a connection to the main tunnel or a long connection tunnel in order to intercept and divert combined sewer overflows into the main tunnel:

a. Acton Storm Tanks (London Borough of Ealing)

b. Hammersmith Pumping Station (London Borough of Hammersmith and Fulham)

c. Barn Elms (London Borough of Richmond)

d. Putney Embankment Foreshore (London Borough of Wandsworth)

e. Dormay Street (London Borough of Wandsworth)

f. Falconbrook Pumping Station (London Borough of Wandsworth)

g. Cremorne Wharf Depot (Royal Borough of Kensington and Chelsea)

h. Chelsea Embankment Foreshore (Royal Borough of Kensington and Chelsea)

i. Heathwall Pumping Station (London Borough of Wandsworth)

j. Albert Embankment Foreshore (London Borough of Lambeth)

k. Victoria Embankment Foreshore (City of Westminster)

l. Blackfriars Bridge Foreshore (Corporation of London)

m. King Edward Memorial Park Foreshore (London Borough of Tower Hamlets)

n. Earl Pumping Station (London Borough of Lewisham)

o. Deptford Church Street (London Borough of Lewisham)

p. Greenwich Pumping Station (London Borough of Greenwich)

2.2.15 At Shad Thames Pumping Station (London Borough of Southwark), there would be no connection to the main tunnel but modifications including new pumps are proposed to better manage existing capacity in the sewer network.

2.2.16 There is a further site, at Bekesbourne (London Borough of Tower Hamlets), where minor works to the existing sewer are proposed. Details of this are given in Section 29.

Beckton Sewage Treatment Works

2.2.17 Upgrades at Beckton Sewage Treatment Works are also required as part of the project to enable the works to cater for the additional volume of combined sewage flows over and above those from the Lee Tunnel.

2.2.18 The overflow from the Lee Tunnel which is being constructed would be re-configured. This would require the construction of two shafts and a new connection tunnel.

2.3 Further information

2.3.1 Volume 1 of the *Environmental Statement* provides an overview of the proposed development. Plans and scheme information submitted for approval are appended to the *Environmental Statement*.

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3 Alternatives

3.1 Introduction

3.1.1 This section describes the main alternatives which have been considered to the proposed development described in Section 2. Where main alternatives have been considered within a site, this is described under ‘Proposed development’ for each site assessment presented in Section 6 - 29.

3.2 Alternatives to a tunnel

3.2.1 A number of alternatives to the tunnel solution have been considered and ruled out. These include:

a. Build a whole new sewer network, separating sewage from rainwater. This would cause huge disruption and be very expensive, costing at least £12 billion.

b. Implement a sustainable drainage system to reduce the rainwater entering the combined network. Sustainable drainage systems will continue to play a part in dealing with rainwater run off but there is not enough open space available for it to meet all of London’s needs. Implementation over a short time frame would be extremely disruptive and costly, while not being that effective at reducing combined sewer overflow discharges. The clay sub soils in London also make sustainable drainage systems a less suitable option in some areas.

c. Install screens at combined sewer overflows to reduce the volume of litter reaching the river. These would rapidly become blocked and risk sewage surging back up into buildings and streets across the capital. This approach would not tackle the underlying problem of sewage polluting the river and so is not a viable alternative.

d. Deploy more vessels on the river to inject oxygen into the river and skim off sewer-related litter. This solution would only treat the symptoms of the problem and so is not a viable alternative and would not be sufficient to meet the requirements of the *EU Urban Waste Water Treatment Directive*.

3.2.2 Once the decision was made that a single tunnel was the only viable solution to the problem of combined sewer overflows (the solution also identified within the National Policy Statement for Wastewater), an extensive study was undertaken to identify the route for the tunnel and the construction sites.

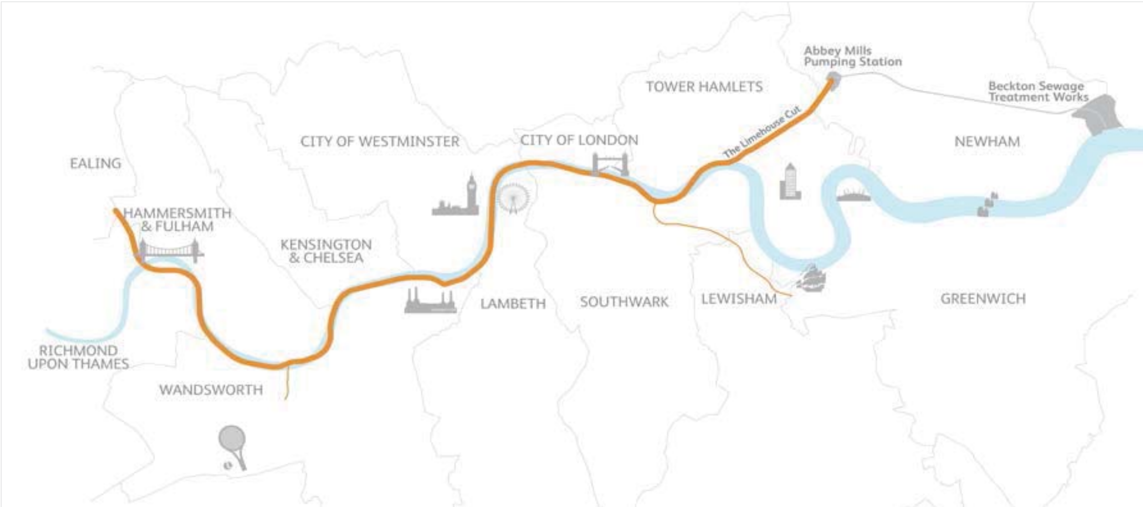
3.3 Alternative tunnel routes

3.3.1 Two alternative tunnel routes to the proposed Abbey Mills Route have been considered, these being the ‘River Thames Route’ and the ‘Rotherhithe Route’. The three routes considered are shown in Figure 3.1.

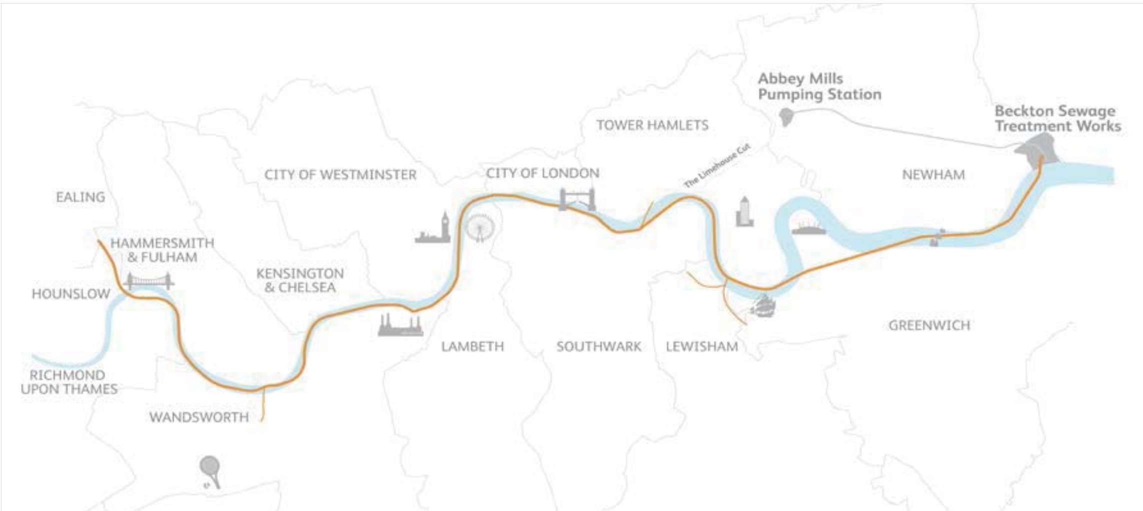
3.3.2 The Abbey Mills route was selected because it has several advantages. The substantial reduction in construction activity associated with the shortest tunnel length and fewest main construction sites, coupled with tunnelling through less difficult ground, resulted in the Abbey Mills route being the safest and most economic construction choice. The Abbey Mills route was also considered to have the least environmental impact given the shorter length of the tunnel and fewer number of main construction sites required.

Figure 3.1 Options for tunnel route

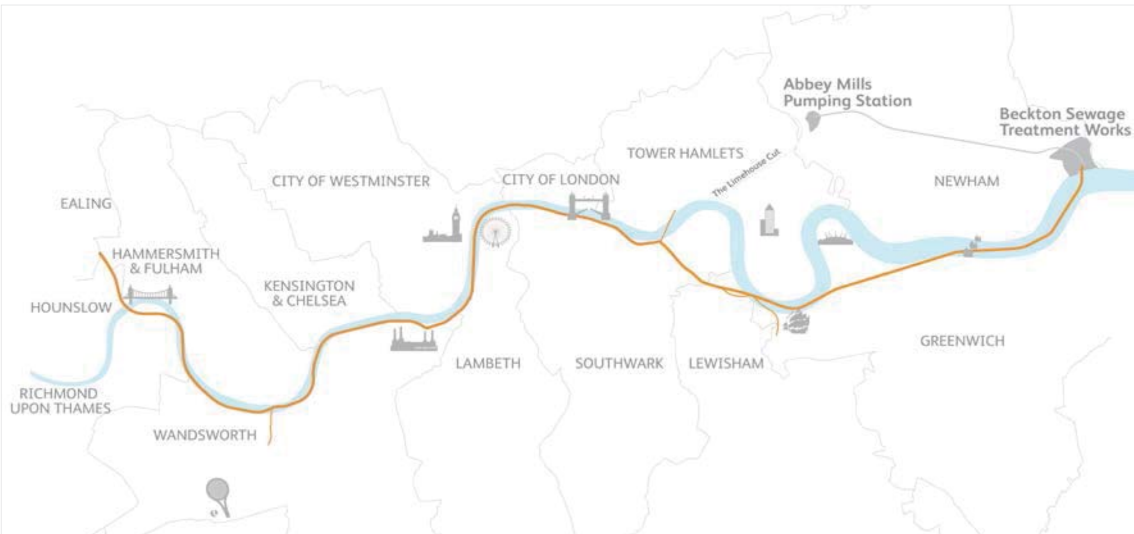
Abbey Mills route – proposed route



River Thames route



Rotherhithe route



3.4 Alternative tunnelling strategies, main drive and reception sites

3.4.1 The selection of a tunnel drive strategy and selection of main drive and reception sites was undertaken in accordance with the published site selection methodology. This methodology used a filtering process to identify a long list of possible sites which was then refined to a short list and eventually a preferred list.

3.4.2 In order to identify a preferred site (each now a proposed site within the application), each of the short-listed sites was assessed across five disciplines: engineering, property, planning, environment and community. The results were then used in multi-disciplinary workshops to identify the preferred sites.

3.4.3 In order to identify the proposed drive strategy, sites were identified within 'zones' (of which there were nine for the Abbey Mills tunnel route). The approach enabled an extensive series of comparisons to be made of tunnelling from one zone to another using the information collected on each of the short-listed sites.

3.4.4 With each comparison made, it was possible to eliminate a number of drive options until the list was finally reduced to one: the preferred (now the proposed) tunnel drive strategy. The comparisons made to arrive at the preferred strategy included:

a. Comparison 1: Comparing the use of Chambers Wharf with the use of King Edward Memorial Park for a main tunnel drive site.

b. Comparison 2: Comparing the use of Barn Elms with the use of Carnwath Road Riverside for a main tunnel drive site.

c. Comparison 3: Comparing the use of Abbey Mills Pumping Station as a main tunnel drive site or main tunnel reception site.

3.4.5 For comparison 1, it was concluded that the preference was to use Chambers Wharf as a main tunnel drive site, thereby eliminating options that use King Edward Memorial Park for this purpose. The main reasons include the brownfield nature of Chambers Wharf and the reduced impacts on park users at King Edward Memorial Park.

3.4.6 For comparison 2, it was concluded that the preference was to use Carnwath Road Riverside as a main tunnel drive site, thereby eliminating options that use Barn Elms for this purpose. The main reasons include the brownfield nature of Carnwath Road Riverside, which also has much better river access via an existing wharf.

3.4.7 For comparison 3, it was concluded that driving the main tunnel from Chambers Wharf to Abbey Mills, should be selected. One of the main factors that influenced this decision was that further technical work and discussions with the Lee Tunnel project team and Olympic Delivery Authority on their experience with the Olympic Park showed that transporting substantial material volumes to and from the site by the River Lee is not desirable. Therefore, the use of Chambers Wharf as a main tunnel drive site, with the ability to transport material by barge, was considered more acceptable than the use of Abbey Mills as a main tunnel drive site with possible reliance on road transport to remove material.

3.4.8 Based on the above comparisons and conclusions reached by all disciplines, the proposed drive strategy for connecting the main tunnel sites was identified as follows:

a. Main drive from Carnwath Road Riverside to Acton Storm Tanks

b. Main drive from Kirtling Street to Carnwath Road Riverside

c. Main drive from Kirtling Street to Chambers Wharf

d. Main drive from Chambers Wharf to Abbey Mills

3.5 Alternative combined sewer overflow interception sites

3.5.1 The site selection methodology was used to compare alternative combined sewer overflow sites. As for the main tunnel drive sites described above, this methodology used a filtering process to identify a long list of possible sites for each of the required combined sewer overflow interceptions. This was then refined to a short list and eventually a preferred list.

3.5.2 For most of the combined sewer overflow interceptions, between two and five short-listed sites were considered in order to identify the preferred site although in a few cases there was only one viable short-listed site. In each case, the preferred site was identified through an integrated multi-disciplinary approach.

3.6 Further information

3.6.1 Volume 1 of the *Environmental Statement* provides further information on the alternatives summarised in this section.

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4 The environmental impact assessment process

4.1 Overview

4.1.1 The purpose of undertaking an environmental impact assessment is to assess how the environment is likely to be affected by a proposal so that measures can be taken, if necessary, to prevent or reduce adverse environmental effects. The main stages in the preparation of the *Environmental Statement* for the Thames Tideway Tunnel have been:

a. scoping

b. gathering information about existing environmental conditions

c. assessment

d. identifying measures to prevent or reduce significant adverse effects (termed mitigation)

e. re-assessment and identification of residual effects

f. reporting.

4.1.2 These stages have been applied to the assessment of each of the 24 sites as well as to the assessment of project-wide effects.

4.2 Scoping

4.2.1 'Scoping' is the term used to describe the process undertaken to define the scope of the assessment in consultation with stakeholders. A *Scoping Report* issued in March 2011 set out the approach to assessing those aspects of the environment with potential to be significantly affected by the proposed development. The following environmental areas were included in the *Scoping Report* and have subsequently been assessed:

a. air quality and odour

b. ecology (river and land based ecology)

c. historic environment

d. land quality

e. noise and vibration

f. socio-economics

g. townscape and visual

h. transport

i. water resources (surface water and ground water)

j. flood risk.

4.2.2 Scoping opinions received from stakeholders were taken into account in gathering information about existing environmental conditions and finalising the methodology for undertaking the assessments.

4.3 Information gathering

4.3.1 Prior to undertaking the assessment, existing environmental conditions (the 'baseline') were identified for each topic.

4.3.2 Information was obtained from observations made on-site, field surveys, information provided by consultees and desk based sources. This allowed the existing environmental resources to be identified and evaluated.

4.3.3 By the time the project starts to be constructed and thereafter, environmental conditions which exist today may have changed. This is irrespective of the Thames Tideway Tunnel project. For example, a new residential development scheduled to be built close to one of the proposed Thames Tideway Tunnel sites would alter the basis of the assessment. For each site, likely changes to existing environmental conditions have been identified and form the basis against which the assessment has been carried out (the 'base case').

4.4 Assessment

4.4.1 In accordance with the *Infrastructure Planning (Environmental Impact Assessment) Regulations* (2009), the assessment presented is of the likely significant effects. The Regulations do not require an assessment of all environmental effects irrespective of significance. To allow this non-technical summary to focus on key information, a distinction has been made between effects which are likely to be significant (both beneficial and adverse) and those which are not.

4.4.2 The assessment for each environmental topic has been informed by legislation, guidance, input from stakeholders and professional judgement. While this varies from topic to topic, best practice has been applied throughout.

4.4.3 The assessment methodology may vary between site specific assessments or the assessment of project-wide effects. For example, modelling has been undertaken for assessing the project-wide effects on river based ecology. This has been necessary to understand the combined effects during construction and operation of all works in the river. This is important in terms of any potential obstruction to the upstream migration of young fish. A different approach may be adopted for individual site assessments. Section 5 presents information on project-wide effects. Assessments have also been carried out at each of the 24 sites.

4.4.4 The assessment process has involved careful consideration of engineering, design, planning, property and environmental factors and has been modified where appropriate to reflect the views of stakeholders. Through this process, significant adverse effects on the environment from the construction and operation of the Thames Tideway Tunnel have been avoided or reduced as far as practicable. Measures to achieve this have been embedded into the project, for example, through the *Code of Construction Practice* described in paragraph 2.2.4. In addition, the assessment process has also sought to enhance beneficial effects.

4.4.5 The assessment of construction effects has taken account of all activities which take place during the construction phase. This includes temporary activities such as construction traffic and temporary haul roads. It also includes those effects which although arising during the construction phase, such as the effects arising from excavation, shaft construction and tunnelling. Construction phase effects would be managed through the implementation of a *Code of Construction Practice*.

4.4.6 Operational effects refer to those effects which arise once the Thames Tideway Tunnel is built and operational. They include effects such as the improvements to water quality and the effects on river based ecology as well as the visual impact of the new operational structures. *Design Principles* submitted for approval would apply to the finished design at each site.

4.4.7 A specific year or years of the project have been used in the assessment. This varies from topic to topic and between assessments of construction and operational effects. For example, the assessment of townscape and visual effects applies a peak construction year when there would be greatest construction activity and hence visual intrusion. For the operational assessment, the opening year is assessed and then also in year 15 in 2037 - 2038 to take account of maturing trees and shrubs which have been planted as part of the proposals. For all topics, consideration has been given to the assessment findings should the programme for the Thames Tideway Tunnel be delayed by approximately one year.

4.4.8 Similarly, the geographical extent of the assessment varies, from topic to topic. In some cases, effects are largely confined to the site, such as archaeology or land quality. For other topics, effects are more widespread most obviously surface water effects on the River Thames.

4.4.9 As part of the assessment, consideration has been given to other developments already under construction or with a planning application submitted. As already described in paragraph 4.3.3, these developments may change existing environmental conditions and have been factored into the assessment accordingly. Where construction of another development is planned to occur at the same time as the construction of a Thames Tideway Tunnel site, there is potential that effects from both schemes constructed together could be greater than if each scheme were constructed at different times. Consideration of these so-called ‘cumulative effects’ has been taken into account in the assessment.

4.4.10 Engagement with stakeholders has taken place throughout the assessment process. Workshops, meetings and feedback on environmental studies have informed both the proposed development as well as the assessment methodology and are documented in full within the *Environmental Statement*.

4.5 Mitigation

4.5.1 Mitigation opportunities can be identified at any stage in the evolution of a project. There has been an iterative assessment process to help refine the project, with the objectives of avoiding and reducing adverse environmental effects. Where practicable and economic, design adjustments have been made to the project and are reflected in the plans and scheme information which are submitted for consent. In addition, as stated in paragraph 2.2.4, a *Code of Construction Practice* has been developed to avoid, reduce and control environmental effects during construction. Examples of such measures include noise enclosures at the three main drive sites (Carnwath Road Riverside, Kirtling Street and Chambers Wharf). At a number of other sites, hoarding would be screened with vegetation around the construction site to reduce visual intrusion (see Section 23 King Edward Memorial Park). *Design Principles* such as fendering on foreshore structures would help promote river based ecology (see Section 9 Putney Embankment Foreshore).

4.5.2 Within the project, most of the aforementioned measures are embedded within the proposals and do not form discrete, ‘add-on’ mitigation measures. For the purposes of assessment, the *Environmental Statement* makes a distinction between measures embedded within the project, which precede the main assessment of each topic and ‘add-on’ mitigation measures which are applied after the main assessment.

4.6 Re-assessment and residual effects

4.6.1 Once any mitigation measures have been incorporated into the proposed development, a further assessment is carried out. The purpose of this is to establish the need and scope for further revisions to the proposal. Any remaining effects – which can be both beneficial and adverse – are then identified as ‘residual effects’. As far as possible, the assessment process has sought to incorporate measures into the proposed development (as embedded measures, see above) and so avoid significant adverse effects. Where these are still predicted to occur, for example visual intrusion during construction or loss of foreshore habitat, this is generally where there are no reasonable measures to address these predicted effects.

4.7 Reporting

4.7.1 There have been a number of environmental reports produced leading up to the preparation and submission of the *Environmental Statement*.

Scoping Report

4.7.2 A *Scoping Report* was issued in March 2011. This gave an overview of the project, explained the assessment methodology and described which environmental topics would be scoped in or out of the assessment at each site (as they existed at the time) and at a project-wide scale. Scoping opinions provided by statutory consultees informed the approach to the assessment, for example, particular methodological aspects or environmental issues at specific sites. This feedback was reflected in the *Preliminary Environmental Information Report*.

Preliminary Environmental Information

4.7.3 As required by the *Infrastructure Planning (Environmental Impact Assessment) Regulations 2009*, Preliminary Environmental Information was prepared to support the Phase 2 consultation undertaken between November 2011 and February 2012. This report (the *Preliminary Environmental Information Report)* documented the findings of the assessment of the proposals undertaken by that point in time to inform the public consultation. Responses received informed and refined both the scheme and the subsequent assessments.

Addenda to Preliminary Environmental Information Report

4.7.4 Following Phase 2 consultation, more substantial potential design revisions at four sites (Barn Elms, Putney Bridge Embankment, Albert Embankment Foreshore and Victoria Embankment Foreshore) triggered the need for targeted consultation. Environmental information accompanied the consultation on these potential changes in order to identify whether they would give rise to materially different effects to those reported in the *Preliminary Environmental Information Report*.

Section 48 Publicity

4.7.5 Section 48 of the Planning Act 2008 requires the application to be publicised prior to submission. Information on the nature and location of the proposed development was provided during the Section 48 publicity phase which took place from July – October 2012. Feedback from this stage was taken into account in the final stages of the assessment as far as possible.

Environmental Statement including non-technical summary

4.7.6 The *Environmental Statement* prepared to accompany the application for development consent comprises 27 volumes and each one is accompanied by a corresponding volume of figures and appendices. The *Environmental Statement* is structured as follows:

a. Volume 1 gives an introduction to the *Environmental Statement* and the main alternatives which have been considered to the project.

b. Volume 2 describes the general methodology as well as the specific methodologies applied by each topic.

c. Volume 3 presents the project-wide assessment.

d. The remaining volumes (Volumes 4 to 27) present the assessment of each site from west (Acton Storm Tanks) to east (Beckton Sewage Treatment Works).

4.7.7 This non-technical summary forms a part of the *Environmental Statement*. To assist explaining the proposed development in the non-technical summary, the following figures (which should not be used for scaling purposes) have been included apart from sites where there would be very limited permanent works or minimal change to the finished site for each site.

Figure X[3].1 – location of proposed site.

4.7.8 This figure has been produced at a scale to show the location of the site in relation to local features and landmarks. This figure also shows the alignment of the tunnel.

Figure X.2 – aerial view of existing site.

4.7.9 This figure is an aerial photograph of the existing site. In order to allow the height of buildings within the site to be shown, the photograph is at an oblique angle. The site boundary has been drawn on to the figure and is shown in a colour to provide a clear contrast against the background photograph. The site boundary corresponds to that in Figure x.1. Reflecting the oblique angle of the photograph, the boundary line has been omitted where it passes behind buildings and structures.

Figure X.4 – proposed development.

4.7.10 The application for the permanent works includes zones within which different elements of the development would be located thereby providing reasonable flexibility necessary for a major infrastructure project. The plan of the proposed development for which consent is sought is appended to the *Environmental Statement*. To aid understanding of this plan, and solely for the purposes of this non-technical summary, an aerial photograph has been superimposed on this plan to show where the different zones of the development would be located. The colour of these zones corresponds to that used in the plan submitted for approval. Again, for the purposes of this non-technical summary, shading has been added to enhance the distinction between different zones and simple labels of what each zone represents added.

Figure X.5 - schematic layout.

4.7.11 This is a three dimensional aerial 'cut-away' figure showing the layout of permanent above and below ground structures. The location of these structures would be within the zones shown in Figure X.4. Since the precise location of these structures has not been determined, figure x.5 is illustrative and not for approval. The inclusion of this figure is intended to help inform understanding of Figure X.4.

Figure X.6 – illustrative aerial view.

4.7.12 Like Figure X.5 this is a three dimensional aerial figure of the finished site including landscaping. As with Figure X.5, this figure is illustrative.

[3] The 'X refers to the particular section of non-technical summary. Section 6 covers Acton Storm Tanks, so Figure 6.1 is the site location for Acton Storm Tanks, Figure 6.2 an aerial view showing the extent of the Acton Storm Tanks site, Figure 6.4 a plan of the proposed development at this site and so on.

4.8 Further information

4.8.1 Volume 2 of the *Environmental Statement* provides information on the overall approach to the assessment methodology including stakeholder engagement. Details are also provided on a topic by topic basis of the particular legislation or guidance which has been applied to the assessments.

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5 Effects at a project-wide scale

5.1 Introduction

5.1.1 For a number of environmental topics, it is likely that there would be effects at a project-wide scale which differ in scale or type to the effects arising at each of the individual sites. For most topics, there is potential for such project-wide effects to arise since the nature of the activity (such as transportation) or of the effect (such as changes to water quality in the River Thames) are not likely to be confined to an individual site. Apart from land based ecology, land quality and townscape and visual effects, all other topics have been assessed at a project-wide scale. The outcomes of these assessments are presented below.

5.2 Air quality and odour

5.2.1 Increases in vehicle emissions as a result of constructing the project, through construction traffic, has the potential to affect air quality at a borough and city-wide level. Therefore a project-wide air quality assessment has been undertaken.

5.2.2 There are not likely to be any significant project-wide effects from river barges, construction plant or construction dust as these would be confined to the immediate vicinity of the Thames Tideway Tunnel sites.

5.2.3 Based on computer modelling, it is predicted that pollutants associated with the Thames Tideway Tunnel construction traffic would not result in a likely significant effect on nearby sensitive properties. This is due to the minor increase in pollutant concentrations predicted.

5.2.4 Project-wide effects for air quality and odour when the Thames Tideway Tunnel is built and operational have not been assessed. The specific site assessments consider odour generated under conditions likely to be encountered during operation. However, effects would be localised with no significant operational project-wide effects considered likely.

5.3 Ecology – river based

5.3.1 The river is a dynamic environment due to tides which carry water, and any pollution from combined sewer overflows, upstream and downstream twice a day. Therefore the project could affect river based ecology.

5.3.2 There would be construction activity in the river at several project sites, which could affect river based ecology. However, with construction controls in place, such as measures to prevent oil or other polluting substances entering the river, effects are not predicted to be significant.

5.3.3 The operational project would deliver significant benefits to river-based ecology, when the interception of each of the combined sewer overflows would result in reduced discharges of untreated sewage into the tidal

Thames. The presence of sewage in the river environment has adverse effects on in-river habitats and species, in particular fish. The operational project would have significant project-wide beneficial effects on invertebrates, fish and also the designated Thames and Tidal Tributaries Site of Importance for Nature Conservation.

5.3.4 There would also be permanent structures in the river at several project sites. The design of these structures would incorporate beneficial features where possible, for example to allow habitats to develop, and they would be shaped to allow easy movement of fish past them. However, these operational structures would, in total, lead to an overall loss of river foreshore of approximately 1.2 hectare, which would have significant adverse effects on habitats and fish populations.

5.3.5 Generally, it is not possible to include measures at each site to mitigate for these adverse effects on the foreshore habitats although in some cases, measures have been integrated into the design. For example, intertidal terraces around the foreshore structure at Albert Embankment Foreshore (Section 18) and a terrace built into the river wall at Dormay Street (Section 10) would promote the re-establishment of foreshore habitats for river-based ecology.

5.3.6 Where effects cannot be mitigated, it is best practice to consider alternative ways to offset the effect. Therefore measures to provide or enhance habitats elsewhere along the River Thames and its tributaries would be progressed in order to compensate for the overall loss of habitat. This includes measures such as removal of disused weirs to allow fish to freely move through the River Thames and its tributaries. These measures would be developed with the Environment Agency.

5.4 Historic environment

5.4.1 Project-wide effects on the historic environment could arise from ground movement resulting from tunnelling. As is the case for tunnel construction generally, some settlement of the ground surface is likely to occur, as soil and rock is removed from below ground. This could cause damage to built structures, for example cracking of masonry. There could also be ground movement due to deep construction works such as shaft construction at the Thames Tideway Tunnel sites themselves.

5.4.2 With a range of construction controls in place, it is not expected that ground movement would give rise to significant adverse effects on any designated historic assets, including listed buildings, bridges, viaducts or stretches of the river wall. Controls would include monitoring, establishing limits of acceptable ground movement and procedures for repair of any listed structures damaged as a result of ground movement. This might include repair of hairline cracks in brick work, or repair of internal features where cracking may occur.

5.4.3 No significant project-wide effects are therefore predicted.

5.5 Noise and vibration

5.5.1 Noise and vibration effects are relatively localised around a fixed source. Given the separation of the sites it is not anticipated that there would be project-wide effects resulting from the summation of noise or vibration effects from individual sites.

5.5.2 Groundborne noise and vibration from the construction of the main tunnel, the Frogmore and Greenwich long connection tunnels and some short connection tunnels have been assessed. The construction processes considered include both the operation of the tunnel boring machines and the temporary construction railway providing materials and equipment to the tunnel face.

5.5.3 No significant adverse project-wide effects have been identified at residential and non-residential properties as the short duration of impacts would be insufficient to cause sustained disturbance to building occupants. However, significant adverse project-wide effects have been identified at certain very vibration sensitive receptors (identified as being very sensitive to vibration due to the sensitive equipment operated by these receptors). In some instances this conclusion is precautionary in the absence of further and more detailed information on these receptors. It is anticipated however that where very vibration sensitive equipment is used, it is mitigated within the building. Where significant adverse effects are identified, property owners may be eligible to apply to the *Thames Tideway Tunnel compensation programme*.

5.5.4 Project-wide effects for noise and vibration once the Thames Tideway Tunnel is built and operational have not been assessed. Noise from storm water flowing through the main tunnel would only be potentially noticeable at the shafts at specific sites and was therefore only considered as part of the site-specific assessments.

5.6 Socio-economic

5.6.1 The potential of the project to affect employment opportunities is considered to be of both borough-wide and city-wide significance. Therefore a project-wide socio-economic assessment has been undertaken considering both contexts.

5.6.2 Significant beneficial project-wide effects are predicted during the construction of the project. It is expected to directly create over 4,000 jobs at the peak of the construction phase and a further 5,000 jobs indirectly. The project would therefore act as a stimulus for London's wider economy as well as communities along the length of the tunnel route.

5.6.3 Once operational, there would be significant long-term beneficial project-wide effects on London's economy and community resulting from the improved recreational opportunities made possible from the river being cleaner and healthier.

5.7 Transport

5.7.1 The project-wide transport assessment considers impacts to London's transport network at both a borough-wide and city-wide level from the combined construction worker and vehicle/barge movements from all Thames Tideway Tunnel project sites.

5.7.2 During construction, the number of heavy goods vehicle movements associated with the project would be small in relation to existing London wide traffic levels. Construction vehicle routes to all of the sites would utilise the Transport for London road network as far as possible, in order to limit the amount of construction traffic needing to use local roads other than for direct access to the sites. For this reason, construction traffic is not expected to have a significant effect on London's road network.

5.7.3 All of the project sites are close to public transport links meaning that construction workers would not need to drive to the sites. The number of construction workers using the public transport network would be relatively small in the context of existing London wide public transport usage and therefore there would be no significant effect on the wider public transport network.

5.7.4 The effect on river navigation patterns varies along the length of the River Thames due to the variation in the number of Thames Tideway Tunnel barge movements along the river. Due to the low number of barges upstream of the Kirtling Street site, effects would not be significant. However, as barge activity associated with the Thames Tideway Tunnel would be greater downstream, thereby leading to increased congestion on the river, this would lead to a significant adverse effect.

5.7.5 Project-wide effects for transport once the Thames Tideway Tunnel is built and operational have not been assessed. There would be very occasional vehicle trips to and from the sites for maintenance activities but these would not have a significant effect on the London wide transport networks.

5.8 Water resources – groundwater

5.8.1 Groundwater is water stored below the surface of the ground, in porous or fractured rocks known as aquifers. The construction of the project including tunnels, shafts and other underground structures, would lead to a requirement to remove water from the ground in a process known as dewatering to enable the new structures to be built. The construction process could also lead to mixing between groundwaters of different quality whilst materials such as some grouts[4] used in construction could also reduce groundwater quality. In addition, when built, the new structures could effect the local flows of groundwater through the rock. It is also possible that leakage into or out of the operational tunnels or shafts could lead to impacts on groundwater quality or levels.

[4] Grout is a thin, coarse mortar poured into various narrow cavities in the ground to improve the engineering properties of poor ground conditions, such as rock fissures, to fill them and consolidate into a solid mass.

5.8.2 As groundwater bodies, including the highly valued chalk aquifer under London, are often connected there is the potential for project impacts at several locations to affect the same groundwaters. Since there is the potential for the construction and operation of the project to affect groundwater at the project-wide level, a groundwater project-wide assessment has been undertaken.

5.8.3 The shafts and the tunnelling do not extend into the lower aquifer within the western area (the construction would be mainly in clay, which does not store usable water) and so no project-wide construction effects on groundwater resources are anticipated here. Within the central and eastern part of the route, there would be several adverse effects on existing licensed abstractions (the locations where others pump out water for their own use) during construction but if the recommended mitigation, including changing pumping depths, is applied, the residual effects would not be significant. No significant operational effects are predicted, as the tunnel would be designed to minimise leakage and leakage volumes (either in or out of the tunnel) would be small.

5.9 Water resources – surface water

5.9.1 The purpose of the project is to improve the water quality in the tidal Thames by substantially reducing the quantity of untreated sewage which is currently released to the river. As the improvements accrue across the wider river, rather than arising in isolation at individual sites, the operational project-wide assessment of surface water is an important assessment. The project-wide assessment also considers effects during construction, from possible impacts such as chemical leakage, pollutant and sediment release, for example from dredging, but no significant negative project-wide effects were identified.

5.9.2 The assessment concludes that the operation of the tunnel would have a significant positive project-wide effect on the water quality in the Thames Tideway, with modelling showing that discharges from the combined sewer overflows would be reduced by approximately 94%, in combination with the operation of the Lee Tunnel and the upgrade works to five sewage treatment works (Mogden, Crossness, Beckton, Long Reach and Riverside) which are currently underway. These reductions would reduce the number of days during which river users are at risk from sewage borne pathogens and the volume of sewage derived litter would also reduce. The reduction in combined sewer overflows would allow compliance with the *EU Urban Waste Water Treatment Directive* and contribute towards meeting the requirements of the *EU Water Framework Directive*.

5.10 Flood risk

5.10.1 The project would introduce new structures into the river during both construction (including temporary areas of land reclaimed from the river, termed a cofferdam), would be constructed to enable a work site to be established and to enable the construction of the shaft and other structures. large temporary cofferdams) and operation (new smaller permanent foreshore structures). These new structures would reduce slightly the ability of the river to transport flows of water up and down its length by acting as ‘blockages’ to flow. The new structures would also take up space within the river and so reduce slightly the maximum volume of water which could be held within the banks of the river. Both of these ‘hydraulic’ changes could increase the flood risk along the length of the tidal Thames.

5.10.2 The project-wide flood risk assessment considers the hydraulic changes in detail. The potential impact on flood risk from the project during both the construction and operation has been assessed using data supplied by the Environment Agency and local authorities. Computer modelling results confirm that the project’s impact on extreme flood levels is likely to be minimal. The results show that minor changes in peak water levels are likely to be experienced; minor increases in the water levels that typically occur in the lower reaches of the Tideway and minor reductions which typically occur in the upper reaches. These changes would not be significant.

5.10.3 The tunnelling process itself may also cause slight settlement of existing structures including river walls, whilst the new structures in the river may cause local changes in flow patterns which could lead to scour of the river bed (loss of existing bed material) and undermining of river walls. These physical impacts could lead to flood defences being lowered or damaged and so could increase flood risk. An engineering review has identified a number of locations where settlement could reduce the effective height of the flood defences and which, if it occurs, could lead to significant effects on flood risk. The flood risk assessment proposes an approach to monitor and remediate settlement to ensure existing levels of defence are maintained and so no significant effects on flood risk in relation to settlement are identified.

5.10.4 Where new structures are built into the river, the new flood defences would reduce the risk of a defence breach or failure occurring at that specific location. The new flood defences would provide an equivalent level of flood defence to the existing situation and the design would include provision for the defences to be raised in the future, if required.

5.10.5 At foreshore sites, surface drainage would drain to the river, however at all inland sites, surface water run-off would be restricted to ensure there is no increase in flood risk to the surrounding area, in accordance with relevant policies on surface water management.

5.11 Further information

5.12 Further information on the assessment of project-wide effects can be found in Volume 3 of the *Environmental Statement*.

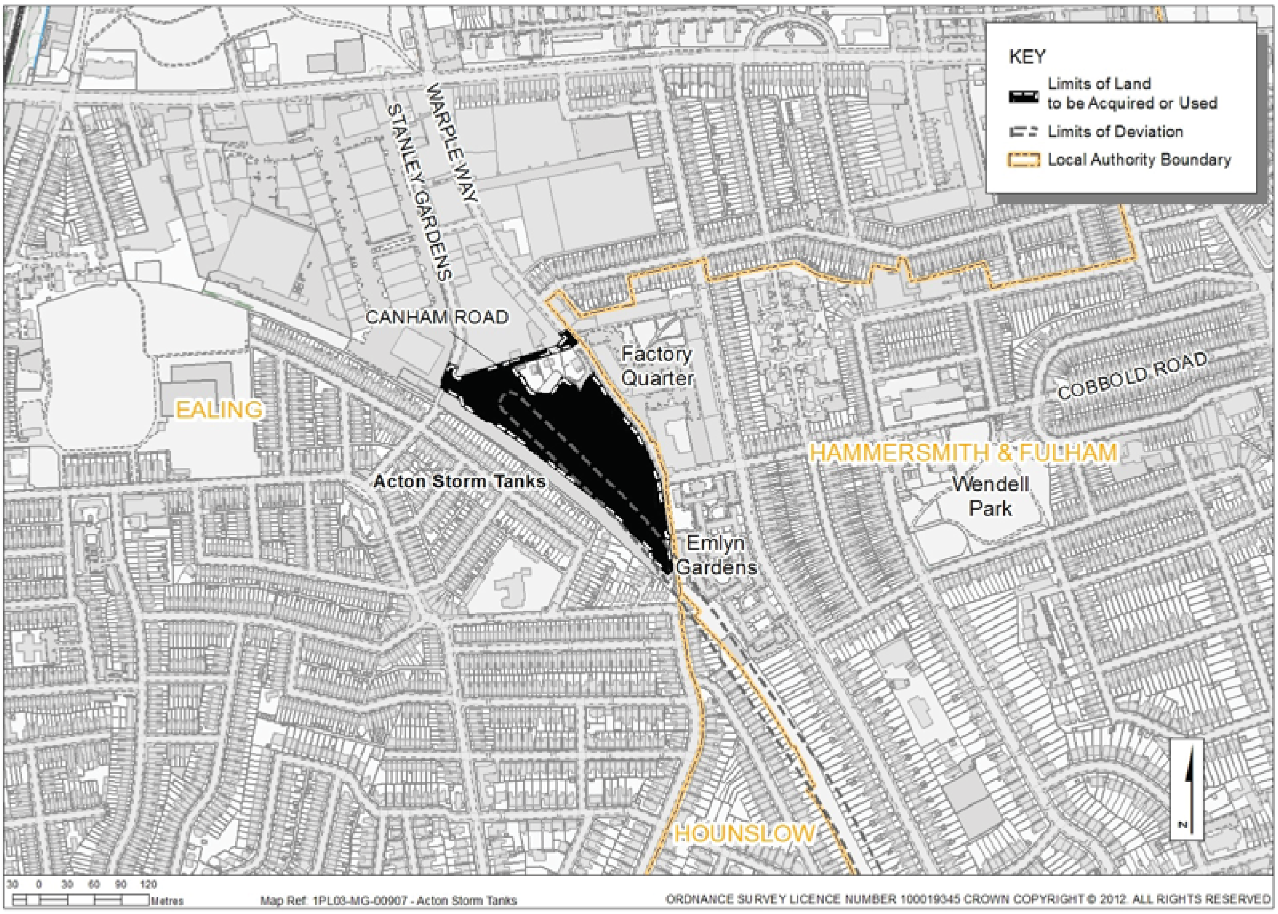
6 Acton Storm Tanks

6.1 Existing site context

6.1.1 Acton Storm Tanks is an existing Thames Water pumping station and storm water tanks site located in the London Borough of Ealing. It is also close to the boundary with the London Borough of Hammersmith and Fulham and the London Borough of Hounslow.

6.1.2 The site is bounded to the north by Canham Road and to the east and southeast by Warple Way. The southwest and west of the site is bounded by a private car park.

Figure 6.1[1] Location of proposed Acton Storm Tanks site



6.1.3 The surrounding area is predominantly residential and mixed-use. The nearest dwellings are to the northeast boundary of the site on Canham Road and Warple Way. Acton Park Industrial Estate is adjacent to the northern boundary of the site. Figure 6.1 - Figure 6.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

6.1.4 Existing site access is via a small access road at the intersection of Canham Road and Warple Way. The site lies inland approximately 1.5km from the River Thames.

Figure 6.2 Aerial view of existing site

6.1.5 Air quality management designations have been made by the London Borough of Ealing and the London Borough of Hammersmith and Fulham covering the whole boroughs. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

6.1.6 There are no other environmental designations on or adjacent to the site.

Figure 6.3 Acton Storm Tanks - site context

View over Acton Storm Tanks

View across storm tanks towards Warple Way

Canham Road

Car parking to west of Acton Storm Tanks

6.2 Proposed development

6.2.1 The purpose of this 2.3 hectare site would be to intercept a sewer which currently discharges untreated sewage into the River Thames on average 29 times each year, at a total volume of 312,000m^3. This is equivalent to approximately 120 Olympic sized swimming pools.

6.2.2 Flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the Thames Tideway Tunnel via a drop shaft.

6.2.3 Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, in most years there would be no discharge at all of untreated sewage into the River Thames from this combined sewer overflow.

6.2.4 During construction, the Acton Storm Tanks site would be utilised to receive the tunnel boring machine used for constructing the main tunnel driven from the Carnwath Road Riverside site west towards the Acton Storm Tanks site. The machine would be lifted out of the shaft by a heavy lift mobile crane before being cleaned and disassembled at ground level. The components would be removed off site via road.

6.2.5 Construction at the Acton Storm Tanks site is assumed to start in 2018 and be complete by 2021. Before construction activity starts, there would be tree planting along the southern side of Warple Way within the site. This would provide visual screening to nearby residents from the construction activities.

6.2.6 A shaft approximately 31 metres deep and with an internal diameter of approximately 15 metres would be constructed towards the northern end of the site within two of the existing storm tanks. Much of the material dug out during the construction of the shaft would be re-used on site to fill in the two surrounding storm tanks, minimising waste and therefore also lorry trips related to moving excavated materials.

6.2.7 Early design and site layout included location of the shaft in the southeastern area of the site, but this was moved to the northern end of the site to help minimise construction noise effects.

6.2.8 There would be an enclosure located over the shaft for the duration of 24 hour working to reduce noise effects on local residents. 24 hour working would be required for the secondary lining phase. During this period of continuous working, activities would be predominately below ground, with support activities occurring at ground level. Lorry movements would be limited to daytime hours.

6.2.9 In addition to this enclosure, there would be other environmental controls in place throughout the construction phase. These would include measures such as damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

6.2.10 During the construction phase, vehicles would access the site utilising the existing one way system. A new vehicle access point would be constructed to the site off Canham Road. The average peak daily number of lorry trips at this site would be 23. There would also be a new temporary access to allow Thames Water to maintain their operations on site at the southern end of the site on Warple Way. Materials would be transported to and from the site by road as the site is inland.

6.2.11 The plan below (Figure 6.4) shows the layout of the proposed development for which consent is sought. The plan shows a series of zones within which different aspects of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

6.2.12 To help explain this information, the schematic diagram below (Figure 6.5) illustrates the layout of where the structures may be located within these zones.

6.2.13 While most of the structures that would be built would be underground, a 15 metre high ventilation column would be a permanent above ground structure. A small number of other structures between 2 – 3.5 metres high are also proposed; these are needed to control and convey sewer flows. During design development, an above ground ventilation building was considered. Structures are now below ground as far as possible to minimise visual intrusion. The height of the ventilation column, in combination with filters included in the design, would control odour and minimise any effect on surrounding residents. The above ground structures are illustrated in Figure 6.6.

6.2.14 Areas of the site would be landscaped including areas of wildflowers and re-provision of trees removed during construction. The works would result in the decommissioning and in filling of the two northern most storm tanks. The remaining four storm tanks would not be filled as part of the site restoration works. It is likely that they would be cleaned and any internal debris removed. Lighting of the operational project would be the same as on the existing operational site.

6.2.15 Once operational there would be routine inspections to the site every three to six months and important maintenance work carried out every ten years. Access to the site would continue to be from Canham Road. The fence line along the southern side of Canham Road would be set back, providing a wider pavement in this area with new fencing.

Figure 6.4 Proposed development at Acton Storm Tanks site

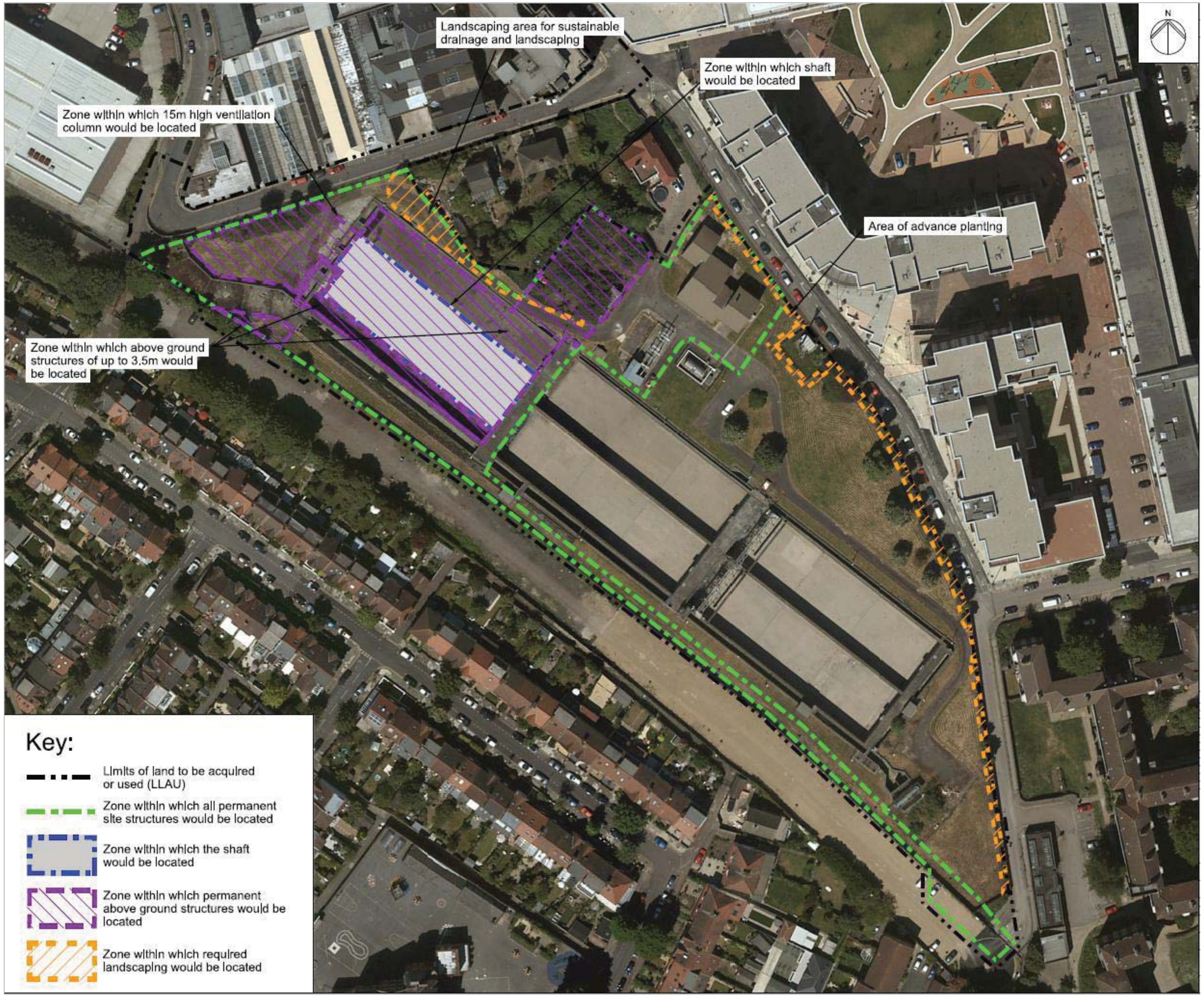


Figure 6.5 Schematic layout of Acton Storm Tanks site

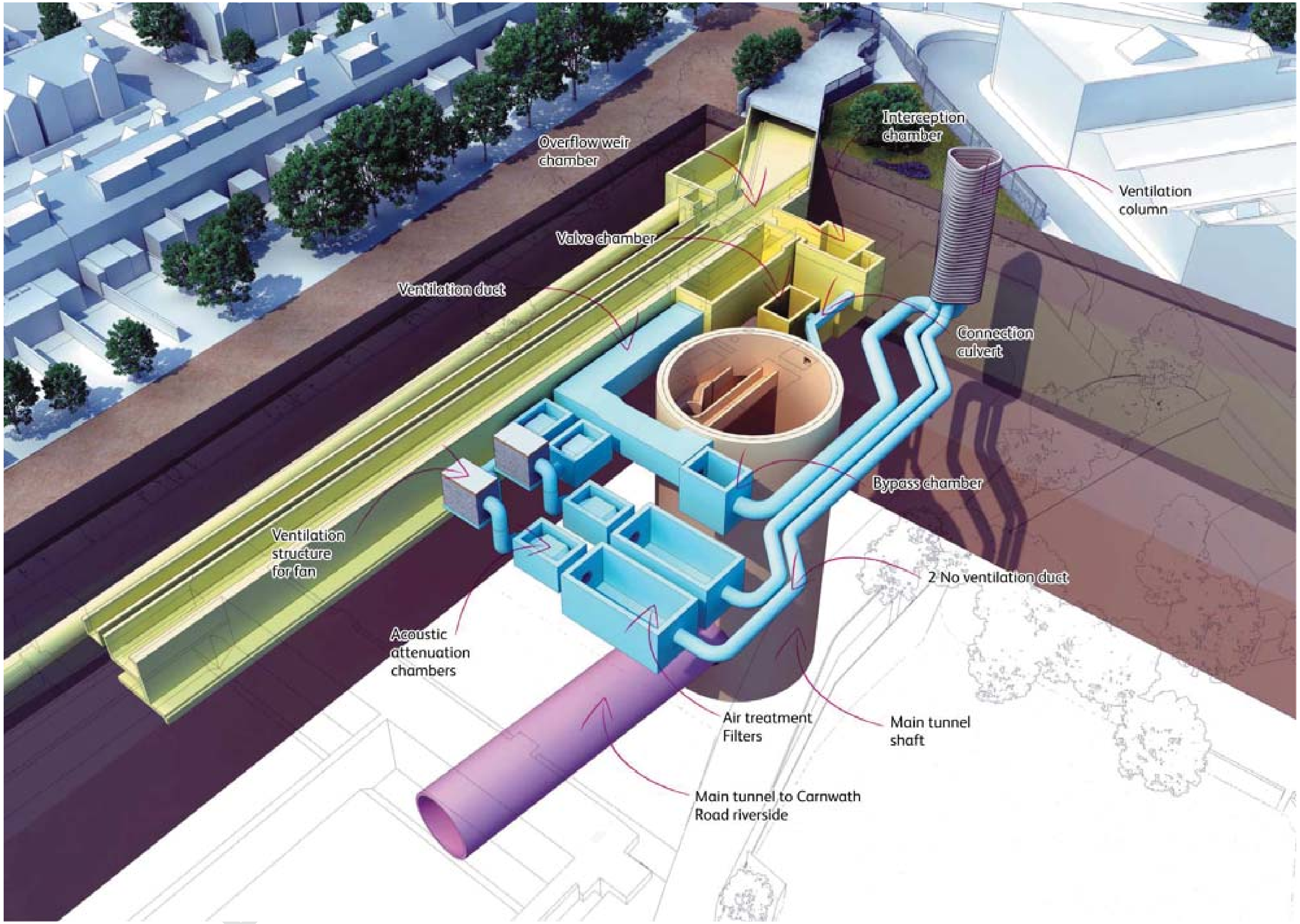
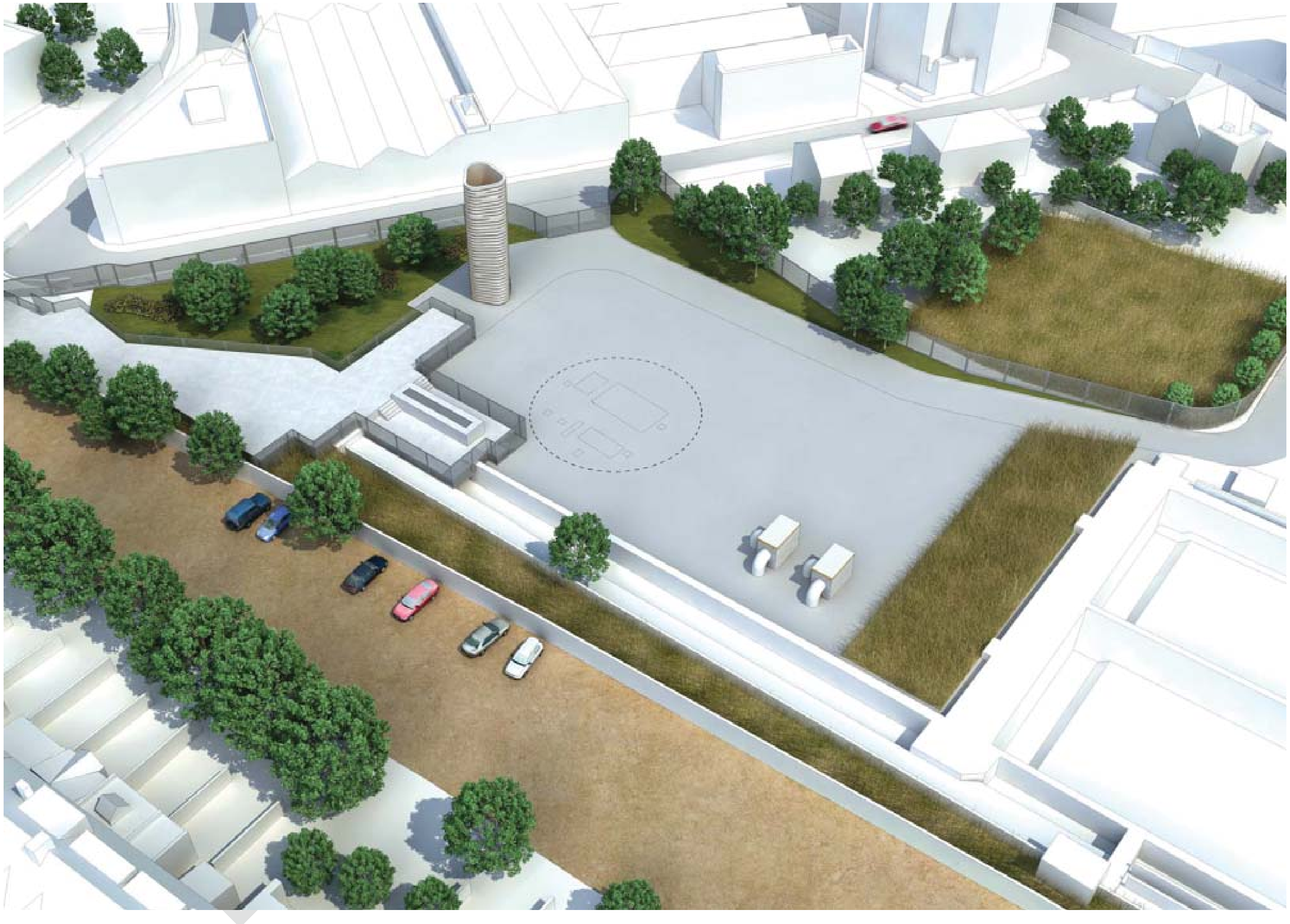


Figure 6.6 Acton Storm Tanks site – illustrative aerial view



6.3 Effects of the proposed development at Acton Storm Tanks on the environment

Introduction

6.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

6.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

6.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Acton Storm Tanks site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 4 of the *Environmental Statement*.

Effects during construction

6.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties. Pollutant levels are currently high across the London Borough of Ealing and the neighbouring authority of London Borough of Hammersmith and Fulham. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in significant effects on nearby sensitive properties. This is due to the minor increase in pollutant concentrations predicted.

6.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

6.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. There would not be any significant noise effects from construction traffic due to the small changes in traffic noise levels predicted. In terms of noise effects from construction plant, the presence of a noise enclosure around the shaft would help reduce noise at night, at times when 24 hour working would be required. Other control measures and barriers to noise between the source of the noise and nearby properties (Figure 6.7) would also help reduce noise. On this basis, there are not likely to be significant effects.

Figure 6.7 Residential properties either side of Warple Way

6.3.7 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

6.3.8 In terms of townscape, there would be only minor alterations to the townscape character typical of a major engineering project including construction equipment such as cranes. The proposals at this site include planting of trees in advance of construction that would help screen construction equipment. Effects would not be significant.

6.3.9 People using the area around the site, including residents and those involved in recreation, may be subject to visual effects, that is effects on their experience of views. Significant adverse effects are likely from residential viewpoints close to the site including Warple Way and Canham Road. This is due to visibility into the site, the presence of construction plant and the noise enclosure. Further away, with only intermittent views of tall construction cranes, effects would not be significant.

6.3.10 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. It also considers local land uses such as nearby amenity space and the community hall (Figure 6.8). Given that the only significant effects identified are from the adverse visual effects of the construction site, and some of these views would be screened through tree planting in advance of construction works starting, the effects on amenity would not be significant.

Figure 6.8 Community hall

6.3.11 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that significant transport effects are minimised. The only significant adverse effect would occur from the temporary restriction of parking spaces along Canham Road, Warple Way and Stanley Gardens which is necessary to allow safe movement of construction vehicles.

6.3.12 A study of historical maps, previous archaeological records and research into local history has been undertaken to build a picture of the possible below ground remains. Construction works would involve changes to both above ground features as well as the environment below ground.

6.3.13 Information gathering has revealed that, although the probability is low, remains from Roman and medieval agricultural practices are possible. Given this, archaeologists would be present on site to observe construction and record any features of interest. Taking this into account, there would be no significant effect on archaeology.

6.3.14 Above ground features of interest include a commemorative stone tablet at the northeastern most edge of the existing storm tanks, listing the names of those involved in the construction of the storm tanks (Figure 6.9). This would be unaffected. Elements of historic machinery that remain on site, possibly from the late 19th century may need to be removed but would be documented first. Therefore, there would be no significant effect on historical features above ground.

Figure 6.9 Commemorative stone table

6.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The current and previous land use as a wastewater treatment and storage facility mean that the site has the potential to be contaminated. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used on major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

6.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a ‘pathway’) is created, resulting in pollution. At the Acton Storm Tanks site, measures such as bunded fuel stores to contain the risk of spills and also the treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

6.3.17 While the Acton Storm Tanks site lies inland, the existing sewer is connected to a discharge point in the River Thames and therefore impacts on surface water may occur. Currently, four of the six storm tanks capture flows during heavy rainfall so this situation would not alter during construction. Two of these storm tanks would be taken up by the proposed shaft. These are currently only held in reserve for very heavy rainfall episodes. If these rainfall episodes occurred (and it is not certain that they would), only a small temporary increase in discharges from the sewer would occur and this would have a minimal and temporary effect on water quality of the River Thames. Therefore, no significant effect is predicted in relation to surface water.

6.3.18 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. Based on the assessment, there would be no change in risk between the existing and future situation that would occur during construction. Therefore there is no significant effect in respect of flood risk.

Figure 6.10 Stamford Brook within Acton Storm Tanks

6.3.19 Construction effects would only occur for river based ecology where construction activities take place in-river. As this site is inland an assessment of construction effects has not been undertaken.

6.3.20 The site is currently of limited land based ecological value. Prior to construction there would be tree planting and at the end of construction, there would be reinstatement of landscaping, wildflower planting and the provision of roosting boxes for bats and nesting boxes for birds. Existing material piles which provide a suitable habitat for invertebrates would be relocated to the area of advance planting.

6.3.21 During construction, control measures would be in place such as noise screening and minimising light spillage so that there would be a minimal effect on birds and bats. Aside from significant beneficial effects on invertebrates and bats, all other effects would not be significant.

6.3.22 No other developments are planned nearby during the same timeframe that would interact with the construction work at the Acton Storm Tanks site and so no significant cumulative effects have been identified.

Effects during operation

6.3.23 The operational site would include a 15 metre high ventilation column whilst air treatment filters would also be installed to remove odour prior to release from the ventilation column. The height of the ventilation column would allow the elevated release of expelled air and therefore there would be no significant effect from odour.

6.3.24 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. Any noise generated by ventilation and other plant equipment would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

Figure 6.11 Car parking along Warple Way

6.3.25 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term temporary parking restrictions on adjacent roads to allow safe access to the site. This relatively minor operational activity would not lead to significant effects.

6.3.26 There are no significant effects predicted on the townscape character areas surrounding the site as features remaining on site would be well designed. Most viewpoints would experience no significant effects. Improvements to the Canham Road boundary and the well-designed above ground features would however result in significant beneficial effect on the view from the corner of Canham Road and Stanley Gardens.

6.3.27 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

6.3.28 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

6.3.29 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected, with no discharges in a typical year, resulting in significant beneficial improvements to water quality (Figure 6.12).

6.3.30 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology. Sewage in the river leads to high levels of bacteria which remove oxygen from the water, leading to the death of fish. Reduced levels of sewage would mean this would happen far less often, resulting in a significant beneficial effect on fish populations. It is also likely that there would be significant beneficial effects from an increase in pollution sensitive fish species and an improvement in the quality of foraging habitat for fish and improved habitat for invertebrates.

Figure 6.12 Acton Storm sewer discharge located on Chiswick Eyot

6.3.31 No other developments are planned nearby that would interact with the operation of the project at the site and so no significant cumulative effects would be likely.

6.3.32 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Given the limited area taken up by the operational site, the infrequent maintenance requirements and that the design would involve only existing lighting, operational land based ecology has not been assessed.

c. Socio-economic effects have not been assessed as the operational structures would be within the existing site boundary.

d. A number of design measures would be included to prevent any contamination related to the operation of the Thames Tideway Tunnel. The finishing of the site with an area of hard standing would prevent any site operators coming into contact with any contaminants retained below ground, and so land quality effects during operation were not assessed.

e. Operational activities would have no effect on aspects of historical interest, below or above ground, and therefore effects on the historic environment have not been assessed.

6.4 Further information

6.4.1 Further information regarding the assessment of the Acton Storm Tanks site can be found in Volume 4 of the *Environmental Statement*.

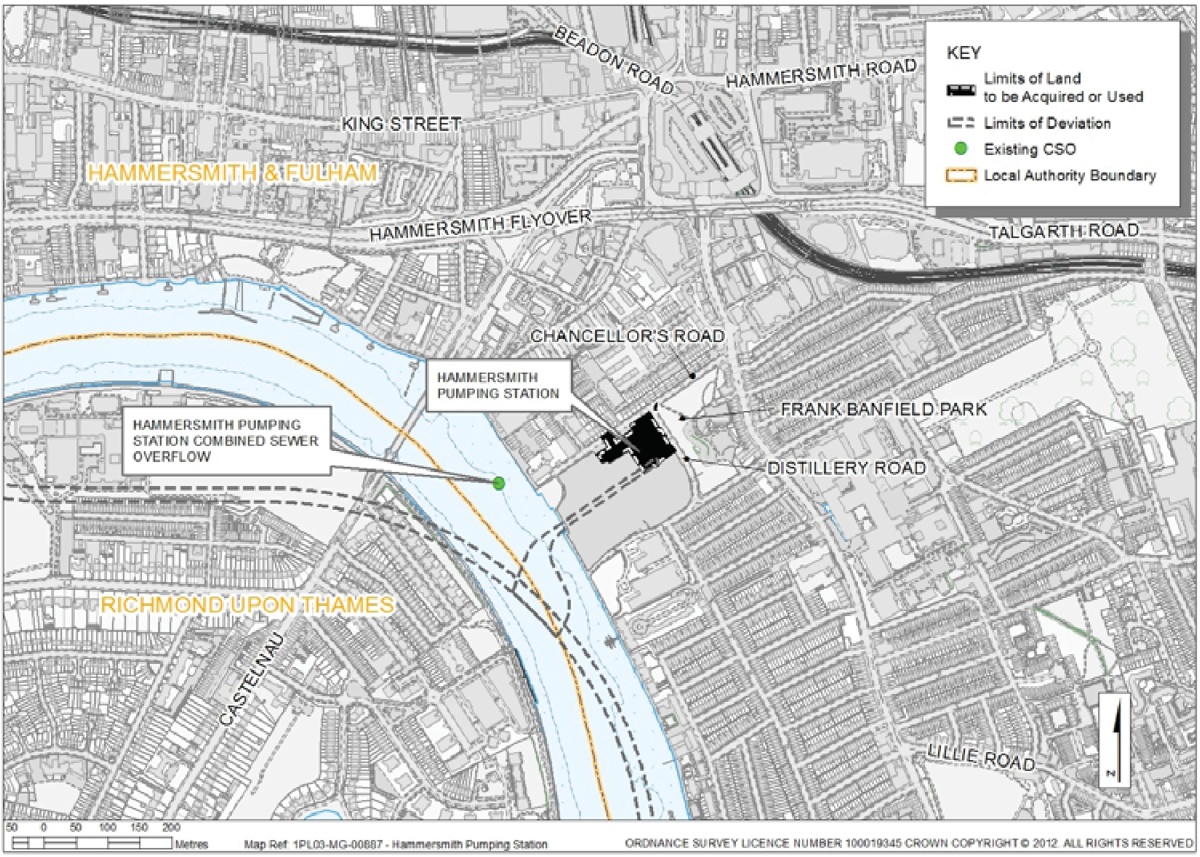
7 Hammersmith Pumping Station

7.1 Existing site context

7.1.1 Hammersmith Pumping Station is an existing Thames Water pumping station site located in the London Borough of Hammersmith and Fulham. The site comprises two parts; the main site covering the pumping station and part of the Fulham Reach development (currently under construction), and a highway works site.

7.1.2 The main site is bounded to the northwest by Chancellor's Road, to the northeast by Distillery Road, and to the southeast and southwest by the Fulham Reach development. The small highway works site is located at the junction of Distillery Road and Chancellor's Road.

Figure 7.1[1] Location of proposed Hammersmith Pumping Station site



7.1.3 The surrounding area is a mix of residential properties and modern office developments. The River Thames is located approximately 100m west of the site, the other side of the Fulham Reach development. Distillery Road separates the site from Frank Banfield Park to the northeast, which includes a children's play area. Figure 7.1 to Figure 7.3 show the site and

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

local context. Existing access to the site is from both Chancellor's Road and Distillery Road.

Figure 7.2 Aerial view of existing site

7.1.4 Air quality management designations have been made by the London Borough of Hammersmith and Fulham covering the whole borough. Such designations are made where pollutant levels (mainly from road vehicles) are above set standards.

7.1.5 The southwest of the site lies within the Winslow Road Archaeological Priority Area and the whole site is within the Fulham Reach Conservation Area. There are no other environmental designations on or adjacent to the site.

Figure 7.3 Hammersmith Pumping Station – site context

View towards Hammersmith Pumping Station from Chancellor's Road

Chancellor's Road

Warning of submerged discharge outlets from Hammersmith Pumping Station

Junction of Chancellor's Road and Distillery Road

7.2 Proposed development

7.2.1 The purpose of main site and highway works site, which cover areas of approximately 0.6 hectares and 0.01 hectares respectively , would be to intercept a sewer overflow which currently discharges untreated sewage into the River Thames on average 51 times each year, at a total volume of 2,210,000m^3. This is equivalent to approximately 884 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, in most years there would be approximately three discharges of untreated sewage into the River Thames from this combined sewer overflow.

7.2.2 At the site, flows would be transferred from the relatively shallow depth of the existing sewers to the deeper level of the Thames Tideway Tunnel via a drop shaft and associated connection tunnel.

7.2.3 Construction at the Hammersmith Pumping Station site is assumed to start in 2017 and be complete by 2020.

7.2.4 A shaft of approximately 33 metres deep with an internal diameter of approximately 11 metres would be constructed in the main site in the area currently under development, known as the Fulham Reach development. Early design had the shaft located in closer proximity to the existing pumping station building. However, the location of the shaft was amended to integrate the Thames Tideway Tunnel proposals into the Fulham Reach development. The existing screening chamber building and sections of the pumping station compound wall would be demolished to enable construction of the shaft and other structures.

7.2.5 Deliveries for, and excavated material from, the construction of the shaft and other structures would be transported by road via a new access on the western side of Distillery Road. As this site is inland, all materials would be transported to and from the site by road, rather than by barge on the river. The average peak daily number of lorry trips at this site would be 21.

7.2.6 Minor kerb modifications would be necessary at the junction of Chancellor's Road and Distillery Road (the highway works site) to enable lorries to negotiate the turn without encroaching on the opposite carriageway or mounting the footway.

7.2.7 Environmental controls would be in place throughout the construction phase. Measures would include damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

7.2.8 A short period of 24-hour working would be required for construction of the connection tunnel and secondary lining works. During this period of continuous working, activities would be predominately below ground, with support activities occurring at ground level. Lorry movements would be limited to daytime hours.

7.2.9 The plan below (Figure 7.4) shows the layout of the proposed development for which consent is sought. The plan shows a series of zones within which different aspects of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

7.2.10 To help explain this information, the schematic diagram below (Figure 7.5) illustrates where the structures may be located within these zones.

7.2.11 While most of the structures would be underground, an above ground ventilation structure would be built adjacent and lower than the existing pumping station. A planted brown roof would enclose the structure to promote local biodiversity. The structure would be a maximum of 4.5 metres high, with the ventilation columns extending to between 8.5 and 9 metres in height.

7.2.12 The height of the ventilation columns, in combination with filters included in the below-ground structures, would control odour and minimise any effect on surrounding residents. These above ground structures are shown in Figure 7.6.

7.2.13 A small electrical control panel would be located within the external compound of the existing pumping station facility.

7.2.14 The area adjacent to the shaft would be hard landscaped to match that proposed as part of the Fulham Reach development. The compound area within the pumping station perimeter would also be hard landscaped to provide an operational working area. Lighting of the operational project would be the same as existing.

7.2.15 Hard surfacing would provide operational vehicle access. During operation, routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Operational vehicle access to the site would be off Distillery Road through the Fulham Reach development.

Figure 7.4 Proposed development at Hammersmith Pumping Station site

Figure 7.5 Schematic layout at Hammersmith Pumping Station site

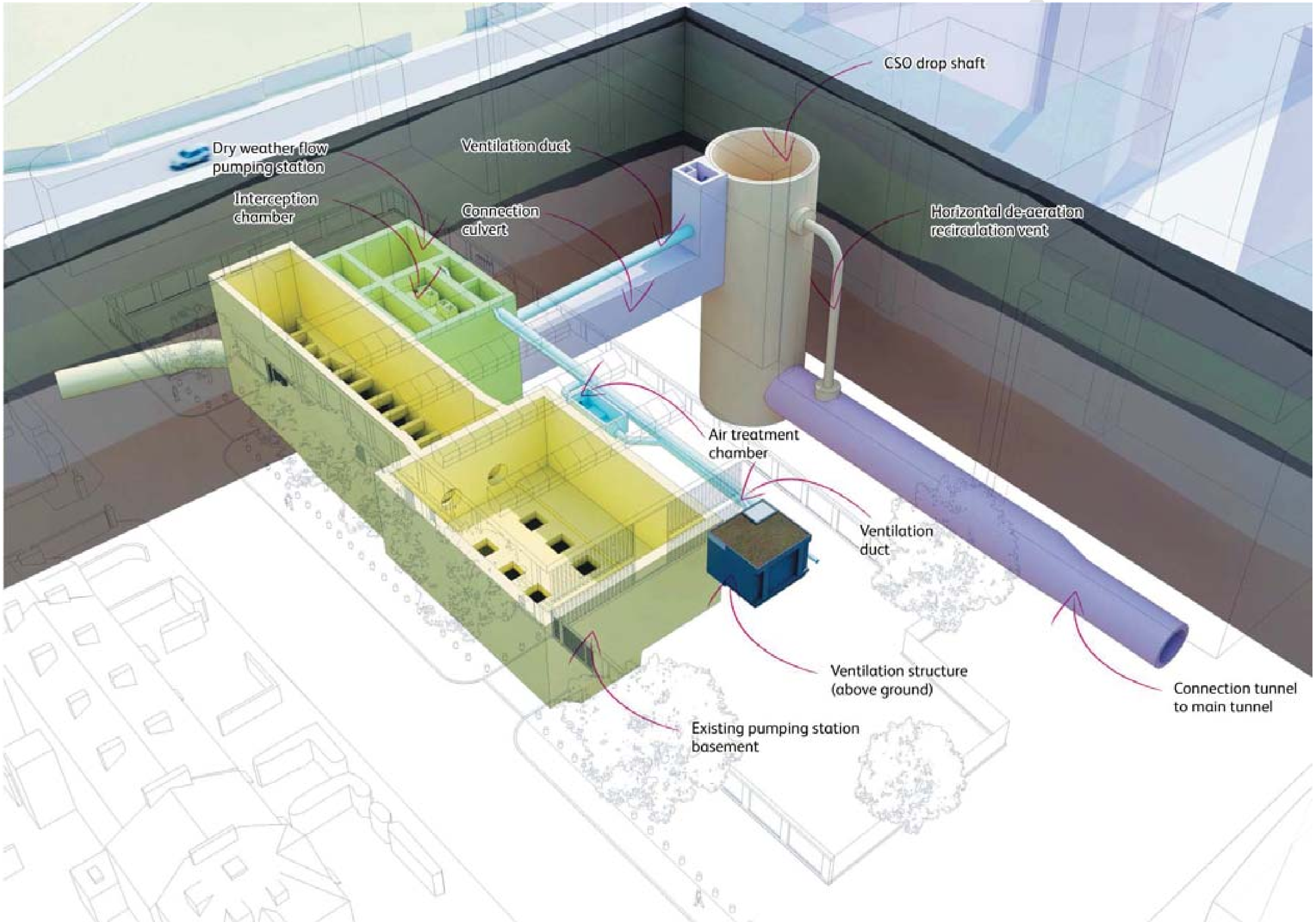


Figure 7.6 Hammersmith Pumping Station site – illustrative aerial view

7.3 Effects of the proposed development at Hammersmith Pumping Station on the environment

Introduction

7.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

7.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

7.3.3 The following section summarises the site effects (both beneficial and adverse) arising from the proposed development at the Hammersmith Pumping Station site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 5 of the *Environmental Statement*.

Effects during construction

7.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents, users of the nearby recreational facilities and any other sensitive properties in the vicinity of the site. Pollutant levels are currently high across the London Borough of Hammersmith and Fulham. However, based on computer modelling, it is predicted that pollutants associated with construction works at this site would not result in any likely significant effects. This is due to the small increase in pollutant concentrations predicted.

7.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

7.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. In terms of noise effects from construction works on site, the presence of control measures, such as avoiding the use of surface cranes during the evening and night time periods and enclosures and temporary stockpiles to provide acoustic screening, would help reduce noise when 24-hour working is required. However, there would be significant adverse effects on parts of the Fulham Reach development due to the construction works at this site. It is not possible to reduce these effects through on site controls. However, the residents of the properties that would be affected by noise may be eligible to apply for noise insulation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*, which if accepted, would reduce the effects to not significant.

7.3.7 There would not be any significant noise effects from construction traffic due to the small changes in traffic noise levels predicted.

7.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

7.3.9 Significant adverse effects on the townscape around the Hammersmith Pumping Station site are predicted. These are due to the change to the townscape character of the area caused by the construction plant and activities at the site.

7.3.10 People using the area around the site, including residents and those involved in recreation (Figure 7.7), may also be subject to visual effects (effects on their experience of views). Significant adverse effects are predicted for a number of viewpoints. These are largely due to the visibility of site hoardings, construction activity, welfare facilities, construction plant and construction traffic.

7.3.11 Consideration of the amenity of local residents and users of the open space at nearby Frank Banfield Park is provided in the assessment of socio-economics. This takes into account the noise, vibration, air quality, construction dust and visual effects on local amenity. Due to the predicted noise effects described above, an adverse significant effect on the amenity of residents is predicted. Amenity effects on users of Frank Banfield Park would however not be significant.

Figure 7.7 Existing Thames Path to the southwest of the site

7.3.12 The measures proposed as part of the project to minimise disruption and ensure the safety of road users, pedestrians and cyclists would ensure that there are no significant transport effects.

7.3.13 Construction works on site would involve changes to both above ground features as well as the environment below ground. Both of these changes have the potential to affect historic assets.

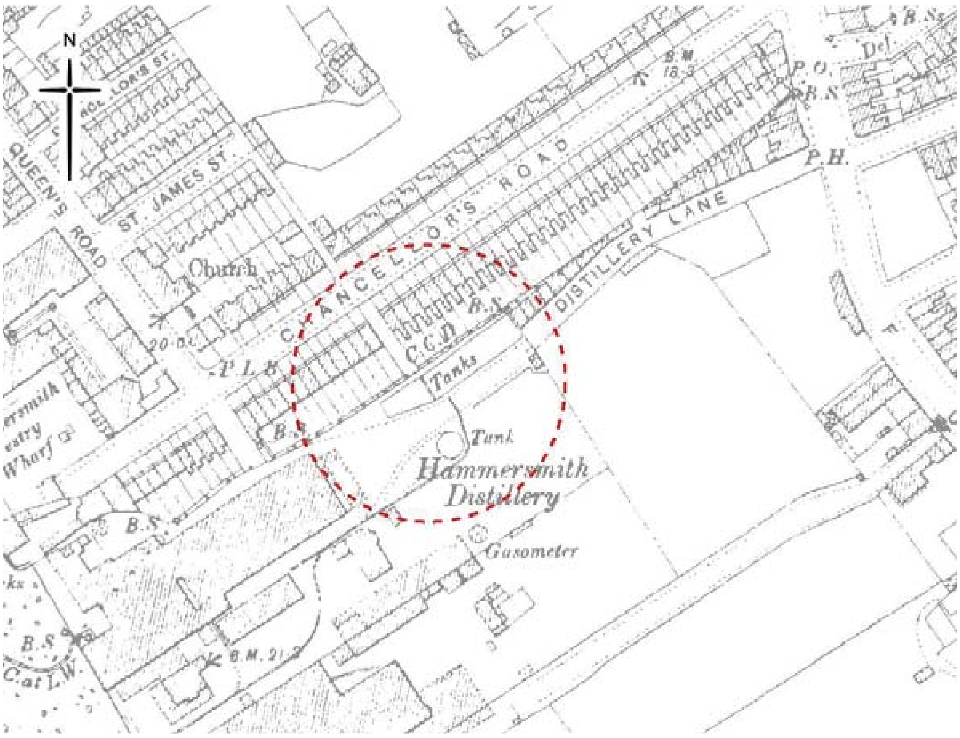
7.3.14 Above ground features of interest include the existing Hammersmith Pumping Station and Hammersmith Bridge. No significant effects on historical features above ground are predicted.

Figure 7.8 Grade II* Hammersmith Bridge

7.3.15 A study of historical maps, previous archaeological records and research into local history have been undertaken to build up a picture of the possible below ground remains. This has revealed that there is potential for below ground heritage assets being present at the site, particularly from the medieval period. Given this, a programme of archaeological investigation would take place to record any features of interest. Taking this into account, no significant effects on below ground assets are predicted. Adverse effects, while not significant, would be likely on above ground heritage including the Fulham Reach Conservation Area and Grade II* Hammersmith Bridge, due to the presence of the construction works.

7.3.16 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination (Figure 7.9). This may in turn affect construction workers and adjacent premises. The site has been subject to a number of potentially contaminative historical and current land-uses, including a distillery, chemical manufacturing and storage and a sewage pumping station. No likely significant effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

Figure 7.9 Ordnance Survey 2nd edition 25" scale map of 1896 (not to scale)



7.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a ‘pathway’) is created, resulting in pollution. At the Hammersmith Pumping Station site, measures such as bunded fuel stores to reduce the risk of spills and treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

7.3.18 As with groundwater, surface water quality can also be affected by when pathways for pollutants are created. At this site a route for pollutants to enter the water may arise during the construction activities with substances used in construction (for example, oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants getting into the river in this way. Surface water from the site would either go into existing drains or be collected on site in tanks that would allow the pollutants to separate from the water before it is released into drains. Based on the application of these measures, no significant effects on surface water would occur.

7.3.19 Flooding may occur from various sources, for example, tidal and fluvial sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, fluvial, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, the finding of the flood risk assessment for the site is that there would be no change in flood risk during construction and there would be no significant effect in respect of flood risk.

7.3.20 The Hammersmith Pumping Station site is an environment that is of limited value to land based ecology. The demolition of some of the existing buildings on site and the removal of three trees close to the entrance of the site would not be likely to have significant effects. Significant beneficial effects are likely due to the provision of bat boxes at the end of construction.

7.3.21 There would be no in-river construction works at this site and therefore construction effects on river-based ecology have not been assessed. .

7.3.22 The topic assessments have considered other developments that are planned nearby during the same timeframe that would interact with the construction work at the Hammersmith Pumping Station site. Cumulative adverse effects are predicted on townscape and viewpoints, noise, amenity of residents and above ground historical features.

Effects during operation

7.3.23 The operational site would include an underground air treatment chamber connected to the above-ground ventilation structure and columns. The below-ground air treatment chamber would include filters that would remove any odours from the air to be released. This would ensure that there are no likely significant effects from odour during operation.

7.3.24 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment located within the kiosk would be minimised by sound insulation. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

7.3.25 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term parking restrictions along Chancellor’s Road and Distillery Road. The ten-yearly maintenance visits would also lead to some temporary, short-term delay to users of the local road network. These infrequent operational activities would not lead to significant effects.

7.3.26 The operational development at Hammersmith Pumping Station would be limited to within the existing pumping station compound and would be largely screened from most of the surrounding area by the presence of compound walls, mature vegetation and buildings. The effect of operational activities on townscape would therefore not be significant. The proposed design is expected to improve the appearance of the site which would positively impact on the historic character and appearance of the surrounding conservation area.

7.3.27 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

7.3.28 The fully built scheme would not alter the existing flood risks and therefore operational flood risk effects would not be significant.

7.3.29 The effect of the proposals at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected, resulting in significant benefits to water quality.

7.3.30 Associated with the improvement in water quality would be significant beneficial effects on the river based ecology. Fish would benefit significantly from the reduced pollution, leading to a general increase in numbers and species diversity. In addition there is likely to be an increase in the distribution of species which are sensitive to pollution.

7.3.31 No other developments are planned nearby that would interact with the operation of the project at the site so no significant cumulative effects have been identified.

7.3.32 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Given the location of the above ground structures within the existing pumping station compound, effects on townscape character and viewpoints are not likely during operation and therefore have not been assessed.

c. The location of the operational structures within a restricted area of the existing pumping station compound, along with the fact that the shaft would be fully incorporated within the Fulham Reach development area. There would therefore not be effects on socio-economic and therefore this has not been assessed.

d. Given the limited area taken up by the operational site, infrequent maintenance requirements and that the design would not require additional permanent lighting, significant effects on land based ecology during operation are not likely and therefore this has not been assessed.

e. Design measures would prevent any contamination related to the operation of the Thames Tideway Tunnel and therefore land quality effects during operation have not assessed.

7.4 Further information

7.4.1 Further information regarding the assessment of the Hammersmith Pumping Station site can be found in Volume 5 of *the Environmental Statement*.

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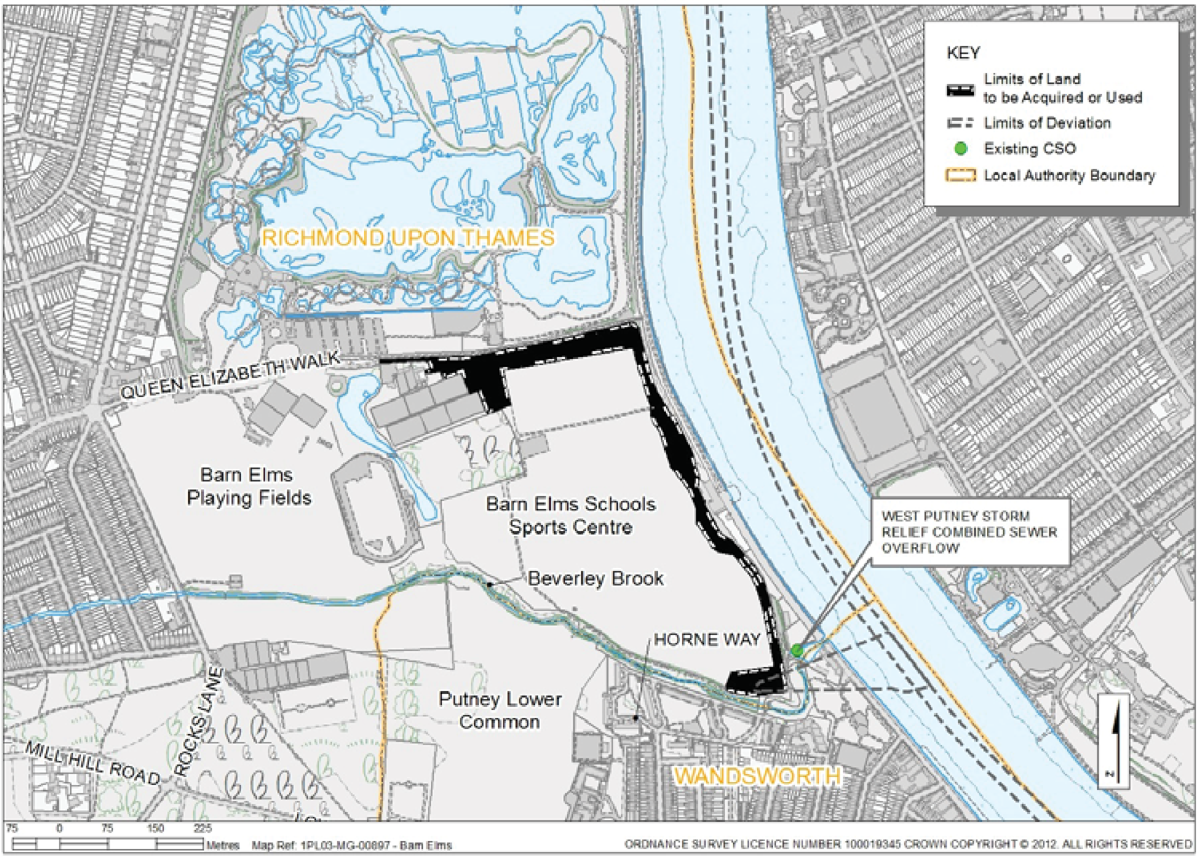
8 Barn Elms

8.1 Existing site context

8.1.1 The proposed development site at Barn Elms is located within the London Borough of Richmond upon Thames. It is also close to the boundary with the London Borough of Wandsworth.

Figure 8.1[1] Location of proposed Barn Elms site

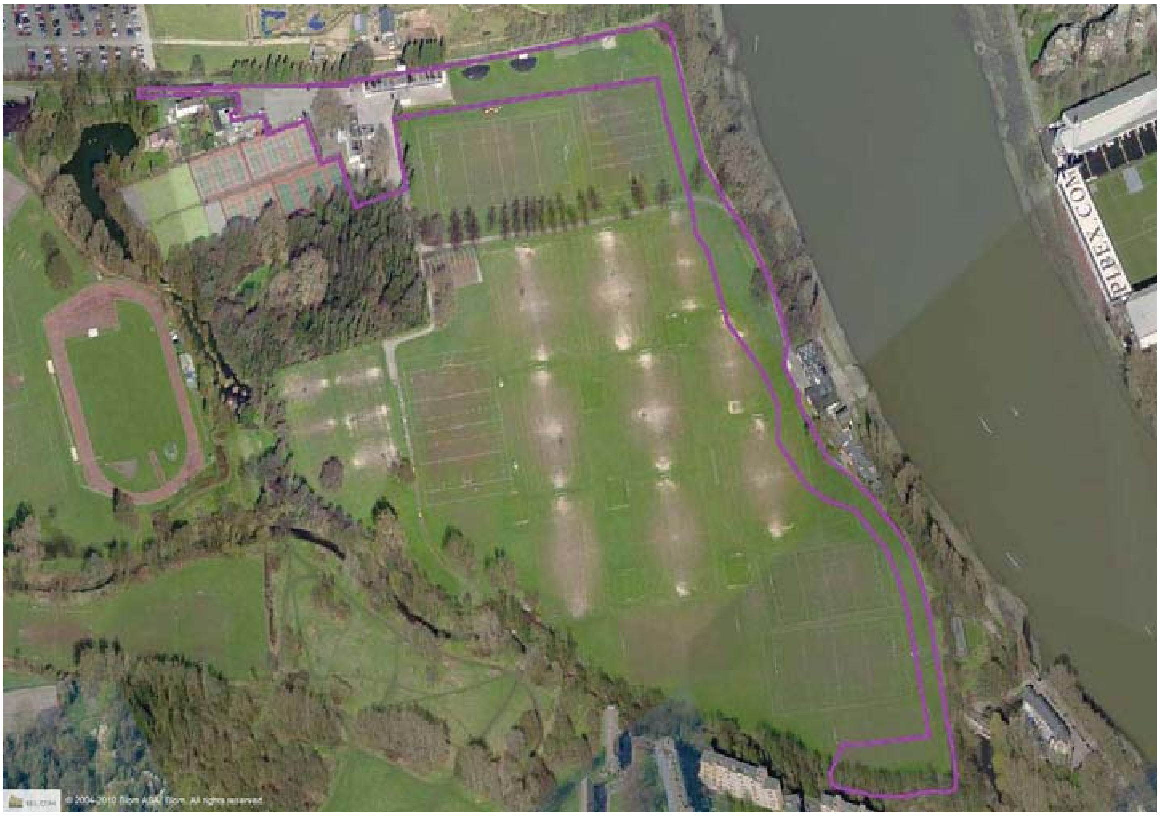


8.1.2 The site is bounded to the north by Queen Elizabeth Walk, to the east by a pedestrian walkway, beyond which is the River Thames, to the south by Leaders Gardens, and to the west by the Barn Elms School Sports Centre.

8.1.3 The surrounding area is a combination of open space, residential and community facilities. The nearest dwellings are to the west of the site along Queen Elizabeth Walk, and to the south of the site along Horne Way. Figure 8.1 to Figure 8.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Figure 8.2 Aerial view of existing site



8.1.4 Road access to the site would be along Queen Elizabeth Walk. There is no existing direct road access to the location of the combined sewer overflow interception.

8.1.5 Air quality management designations have been made by the London Boroughs of Richmond upon Thames and Wandsworth covering the whole boroughs. These designations have been made where pollutant levels (mainly from road vehicles) are above set standards.

8.1.6 There are a number of ecological designations on, or adjacent to, the site. The London Wetland Centre is located immediately to the north of Queen Elizabeth Walk. The southern areas of the centre are a Site of Importance for Nature Conservation and the remainder is a Site of Special Scientific Interest. The designated River Thames and Tidal Tributaries to the east of the site and Beverley Brook to the south of the site are both Sites of Importance for Nature Conservation. In addition, the Barn Elms Playing Fields Site of Importance for Nature Conservation encompasses an extensive area of the site.

8.1.7 Most of the site lies within the locally designated Barnes Common Archaeological Priority Area.

8.1.8 There are no other environmental designations on or adjacent to the site.

Figure 8.3 Barn Elms – site context

View over track facilities

Scout centre facing onto Thames Path

Confluence of Beverley Brook and River Thames

View from river towards Thames Path

8.2 Proposed development

8.2.1 The purpose of this 3.1 hectare site would be to intercept a sewer which currently discharges untreated sewage into the River Thames on average 30 times each year, at a total volume of 35,000m^3. This is equivalent to approximately 14 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed main tunnel, in most years there would be one discharge of untreated sewage into the River Thames from this site.

8.2.2 Flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the main tunnel via a drop shaft and associated West Putney connection tunnel.

8.2.3 Construction at the Barn Elms site is assumed to start in 2017 and be complete by 2019.

8.2.4 A shaft of approximately 34 metres deep with an internal diameter of approximately 6 metres would be constructed in the southern region of Barn Elms Schools Sports Centre playing fields.

8.2.5 Deliveries for, and excavated material from, the construction of the shaft and other structures would be transported by road. Where practical, lorries would avoid accessing the site between 8am and 9am Monday to Friday and over the weekend to minimise local congestion.

8.2.6 A temporary construction access road would be required to serve the site. The route would be off Queen Elizabeth Walk, along a short length of private road and across the northern and eastern perimeters of the Barn Elms Schools Sports Centre. Vehicle management would be employed to avoid vehicle conflict with other users of the existing private road. It is not proposed to widen the short length of private access road which serves the school sports centre. The average peak daily number of lorry trips at this site would be 22. This peak would be for a period of approximately one month.

8.2.7 The route of the construction road would require the demolition of an existing changing room facility and moving of the track and field facilities. Alternative changing rooms and track and field facilities would be provided prior to the commencement of any works. The exact location and specification of these facilities is subject to agreement with the landowners, the London Borough of Wandsworth.

8.2.8 Early design and layout showed a construction access route running parallel to the Beverley Brook watercourse and an entirely new access connecting directly onto the Rocks Lane carriageway. The route of the access was amended following feedback received from local stakeholders.

8.2.9 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, ensuring safety for road users and pedestrians by controlling movement of vehicles, and restricting working hours to limit the effects of noise on neighbours.

8.2.10 A short period of 24 hour working would be required for the West Putney connection tunnel and secondary lining. During this period of continuous working, activities would be predominately below ground, with support activities occurring at ground level. Lorry movements would be limited to daytime hours.

8.2.11 The plan below (Figure 8.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which different components of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

8.2.12 To help explain this information, the schematic diagram below (Figure 8.5) illustrates where the structures may be located within these zones.

8.2.13 While most of the structures would be underground, an integrated above ground ventilation structure and electrical and control kiosk would be built. This would be surrounded by cladding to minimise its visual appearance and voids within the cladding would be filled with a variety of media to provide suitable habitat for different species. A planted brown roof would enclose the structure to promote local biodiversity. The structure would be between 4 to 6 metres in height.

8.2.14 The height of the structure, in combination with filters included in the below-ground structures, would control odour and minimise any effect on surrounding residents and users of the playing fields. These are shown in Figure 8.6.

8.2.15 The area immediately adjacent to the below ground structures would be finished in a hard landscape material with the remainder of the operational hardstanding area being reinforced grass. This would facilitate safe operational access, whilst retaining a natural appearance.

8.2.16 A level difference is required for hydraulic reasons between the existing sports fields and the elevated operational hardstanding area. This slope would be planted with native grass species.

8.2.17 Towards the latter stages of construction, the temporary construction access road would be removed and replaced with a permanent road for operational access. The finish of the permanent road would be reinforced grass to minimise its visual intrusion.

8.2.18 No lighting would be provided as part of the operational project, except for a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

8.2.19 Once operational, routine inspections would be made every three to six months and important maintenance work carried out every ten years. Operational access to the site would be from a new permanent access road from the existing changing room area at the end of Queen Elizabeth Walk.

Figure 8.4 Proposed development at Barn Elms site

Figure 8.5 Schematic layout at Barn Elms site

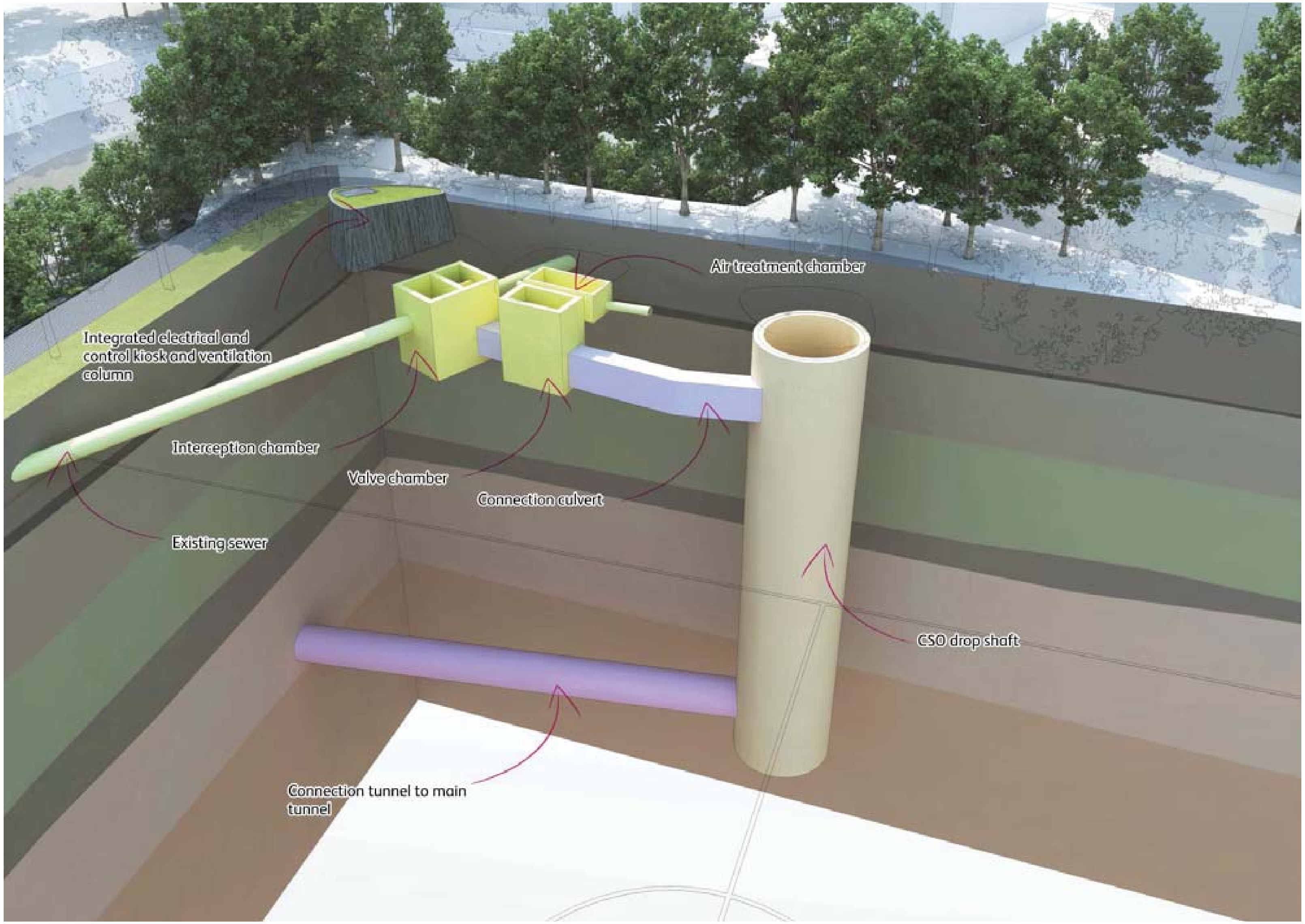


Figure 8.6 Barn Elms site – illustrative aerial view

8.3 Effects of the proposed development at Barn Elms on the environment

Introduction

8.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

8.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

8.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Barn Elms site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the main tunnel is built and operational. The full details for each topic are contained in Volume 6 of the *Environmental Statement*.

Effects during construction

8.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This could affect local residents and other nearby sensitive properties. Based on computer modelling it is predicted that pollutants associated with construction works would not result in significant effects on nearby sensitive properties or those people using the area around the site for recreation or on the ecology of the London Wetland Centre. This is due to the minor increase in pollutant concentrations predicted.

8.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

8.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. The extra vehicles associated with the construction would result in a small increase to future traffic levels however this would not result in a significant increase in noise.

8.3.7 The noise of construction activities, generated by construction plant and vehicles, would be controlled on site through measures including the use of site hoarding. However, during certain periods of construction, significant adverse noise effects are predicted at Lancaster House to the south of the site. It is not possible to further reduce the noise effects through on site controls. However the residents of properties that may be affected may be eligible to apply for compensation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*.

8.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

8.3.9 In terms of townscape, there would be significant adverse effects on the site and wider recreational area. This is due to the introduction of site hoardings, construction activity, road transport and cranes into an area of open green space. More widely, the character of the wider townscape is not likely to experience significant effects due to the distance from the construction works and screening provided by trees and buildings.

8.3.10 People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects, that is effects on their experience of views. Significant adverse effects have been identified on residential viewpoints along Horne Way, immediately to the south of the site, due to visibility of construction works. No other viewpoints are predicted to experience significant effects as the construction works would be only being partially visible and would be filtered by trees and buildings.

8.3.11 Consideration of the amenity of local residents and users of open space and community facilities is provided in the assessment of socio-economics. This takes into account the findings of the noise, vibration, air quality, construction dust and visual assessments. No likely significant effects have been identified on users of open space and community facilities. For example, effects on the users of the Barn Elms School

Sports Centre (Figure 8.7) would not be significant because changing room facilities and car parking would be provided prior to the construction of any works. Thames Water would liaise closely with the sports pitch organisers to minimise adverse effects on the configuration and use of pitches. Significant effects have been identified on the amenity of nearby residents on Horne Way, due to the adverse noise and visual effects predicted. These effects would only occur during certain periods when particular activities are taking place, and at other times the effects would not be significant. No significant effects on amenity have been identified for other residents.

Figure 8.7 Barn Elms – Barn Elms Schools Sports Centre playing fields

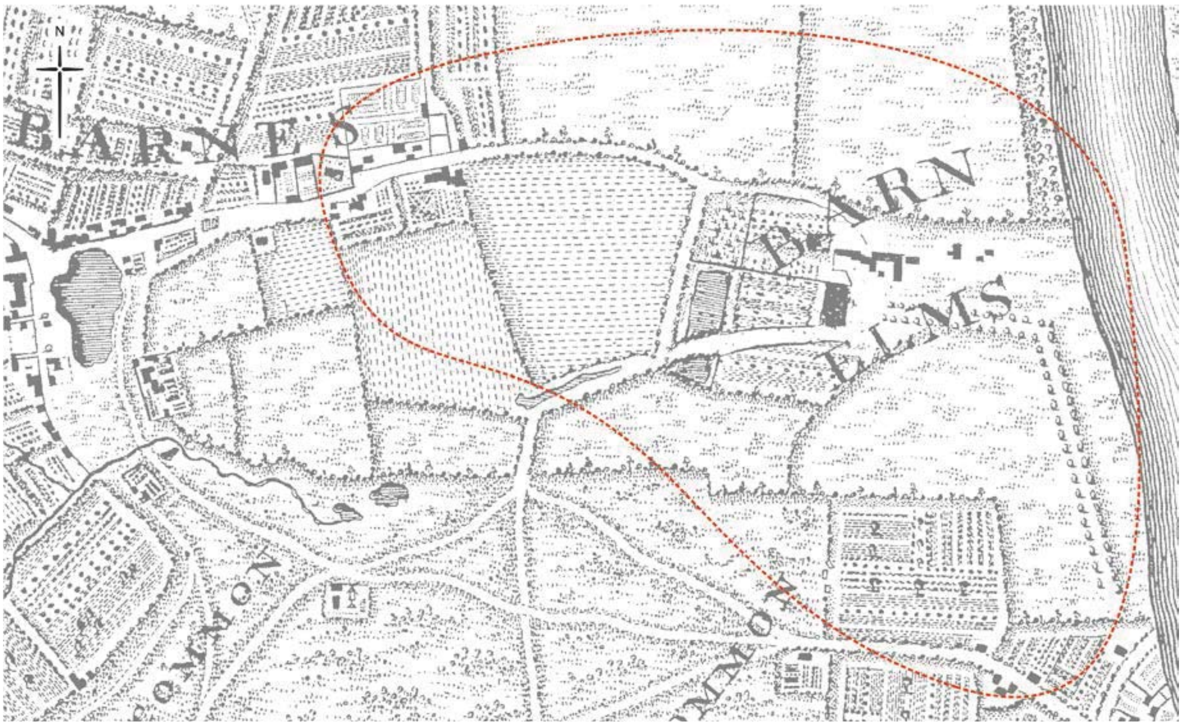
8.3.12 The measures proposed as part of the project to minimise disruption and ensure the safety of road users and pedestrians, including provision of replacement parking at the Barn Elms Schools Sports Centre, would ensure that there would be no likely significant transport effects.

8.3.13 A study of historical maps (Figure 8.8), previous archaeological records and research into local history has been undertaken to build up a picture of the possible below ground remains. Construction work on site would involve changes to both above ground features as well as the environment below ground.

8.3.14 Information gathering has revealed that the site has high potential to contain evidence of prehistoric settlement and structures, as well as other archaeological remains, although the latter would be of less value in terms of building up an understanding of the early history of the area. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

8.3.15 There are no above ground structures which could be physically affected or affected by a change in historic setting. Therefore no significant effects are predicted. The Barn Elms playing fields and schools sports centre are of some historic value, as they form remnants of medieval and post-medieval parkland. The construction works would not have a significant effect on the historic parkland.

Figure 8.8 Barn Elms – Rocque's map of 1741–1745



8.3.16 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The site has no history of contaminative land uses and the current land-use of playing fields is unlikely to have caused contamination. Therefore no significant effects have been identified.

8.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created, resulting in pollution. At the Barn Elms site, measures such as bunded fuel stores to contain the risk of any spills and treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

8.3.18 While the Barn Elms site lies inland of the river wall, construction activity could affect water quality in the River Thames or the Beverley Brook through rainfall carrying pollution from the site to the river. However, with the proposed site drainage and construction practices in place to minimise the risk of pollution, no significant effects are likely.

8.3.19 Flooding may occur from various sources, for example, tidal and river sources (Figure 8.9), as well as surface water, groundwater and sewers. Currently there is a risk of tidal and river-sourced flooding at this location. Based on the assessment, there would be no change in risk between the existing and future situation that would occur during construction. Therefore there is no significant effect in respect of flood risk.

Figure 8.9 Mouth of the Beverley Brook at low tide

8.3.20 As this site is land-based, with no construction works taking place within the river, there would be no significant construction effects on the ecology of the River Thames or Beverley Brook.

8.3.21 The site and surrounding area provide habitat for a range of species, including badgers, bats, birds and invertebrates. This is reflected in the designation of habitats around the site for their ecological value. No likely significant effects are predicted on bird populations from disturbance due to noise because of the distance of the main areas used by wetland birds from the construction access road and the presence of screening vegetation. Other species found within the site or surrounding area are not predicted to experience significant adverse effects due to the small extent of temporary loss of habitat. Disturbance effects would also be minimised through construction controls including on lighting. At the end of construction some beneficial features would be introduced including more species rich grassland, bat boxes, and a habitat wall and planted brown roof on the electrical and control kiosk. It is predicted that these features would result in significant beneficial effects for bats and invertebrates.

8.3.22 No other developments are planned nearby during the same timeframe that would interact with the construction work at the Barn Elms site and so no significant cumulative effects have been identified.

Effects during operation

8.3.23 The operational site would include a four to six metre high ventilation column, and air treatment filters would also be installed to remove odour prior to release from the ventilation column. The height of the ventilation column would allow the elevated release of expelled air and so there would be no significant effect from odour.

8.3.24 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, and as flows would be underground there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

8.3.25 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would be required. This relatively minor operational activity would not lead to significant transport effects.

Figure 8.10 Local signs for walkers and cyclists

8.3.26 No significant effects on the townscape character of the site or surrounding area are predicted from the introduction of the new above ground structures and no viewpoints are predicted to experience significant effects. The structures would either not be visible or would be barely perceptible from residential viewpoints or from most viewpoints in recreational areas.

8.3.27 The amenity effects on users of the Barn Elms School Sports Centre open space have also been assessed. No significant effects are predicted from the permanent changes to the open space because there would be no loss of sports pitches, nor any reduction of playing field capacity or functionality.

8.3.28 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be low due to how the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

8.3.29 The fully built project would not alter existing flood risks, and therefore operational effects on flood risk would not be significant.

8.3.30 The effect of the proposals at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected, with one discharge in a typical year, resulting in a significant beneficial effect on water quality.

8.3.31 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology. Sewage in the river leads to high levels of bacteria which remove oxygen from the water, leading to the death of fish. Reduced levels of sewage would mean this would happen far less often, resulting in a significant beneficial effect on fish populations. It is also likely that there would be significant beneficial effects from an increase in pollution sensitive fish species and an improvement in the quality of foraging habitat for fish. Invertebrates and habitats would also see improvements, although these effects are not likely to be significant.

8.3.32 No other developments are planned nearby within the same timeframe and which could interact with the operation of the project at the site and so no significant cumulative effects have been identified.

8.3.33 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no effects in terms of land quality, or on aspects of historical interest, below or above ground therefore these topics have not been assessed.

c. Given the limited area taken up by the operational site, the infrequent maintenance requirements and the fact that the design would involve minimal lighting being used, significant effects on land based ecology are not likely, and therefore this has not been assessed.

8.4 Further information

8.4.1 Further information regarding the assessment of the Barn Elms site can be found in Volume 6 of the *Environmental Statement*.

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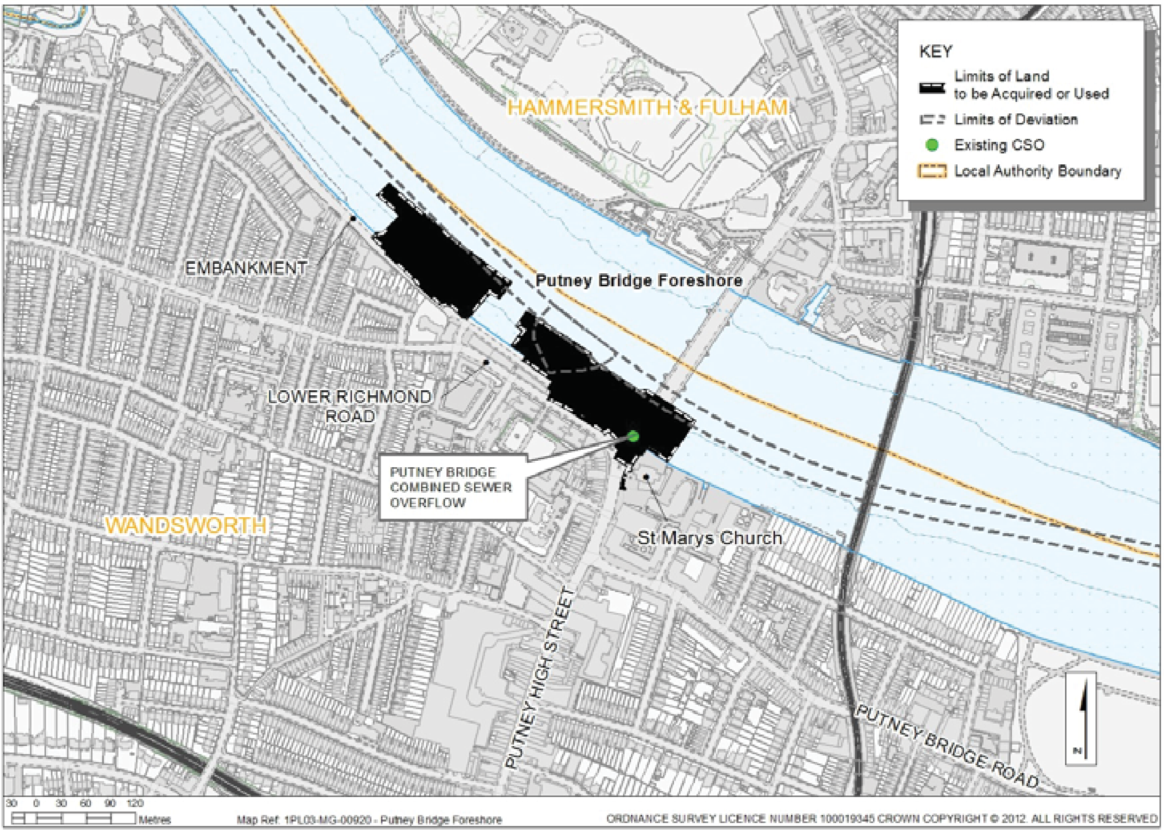
9 Putney Embankment Foreshore

9.1 Existing site context

9.1.1 The proposed Putney Embankment Foreshore site is located in the London Borough of Wandsworth on the southern bank of the River Thames. The proposed development consists of a main site, which would be used to intercept the combined sewer overflow, as well as a secondary site which is required to provide a temporary slipway.

9.1.2 The main site is bounded by the River Thames to the north, the Grade II* listed St Mary's Church to the east, the Embankment carriageway and Lower Richmond Road to the south, and Putney Pier to the west. The site for the temporary slipway is approximately 300m northwest of the Grade II listed Putney Bridge, and is bounded by the Embankment carriageway to the south and the River Thames on all other sides.

Figure 9.1[1] Location of the proposed Putney Embankment Foreshore site

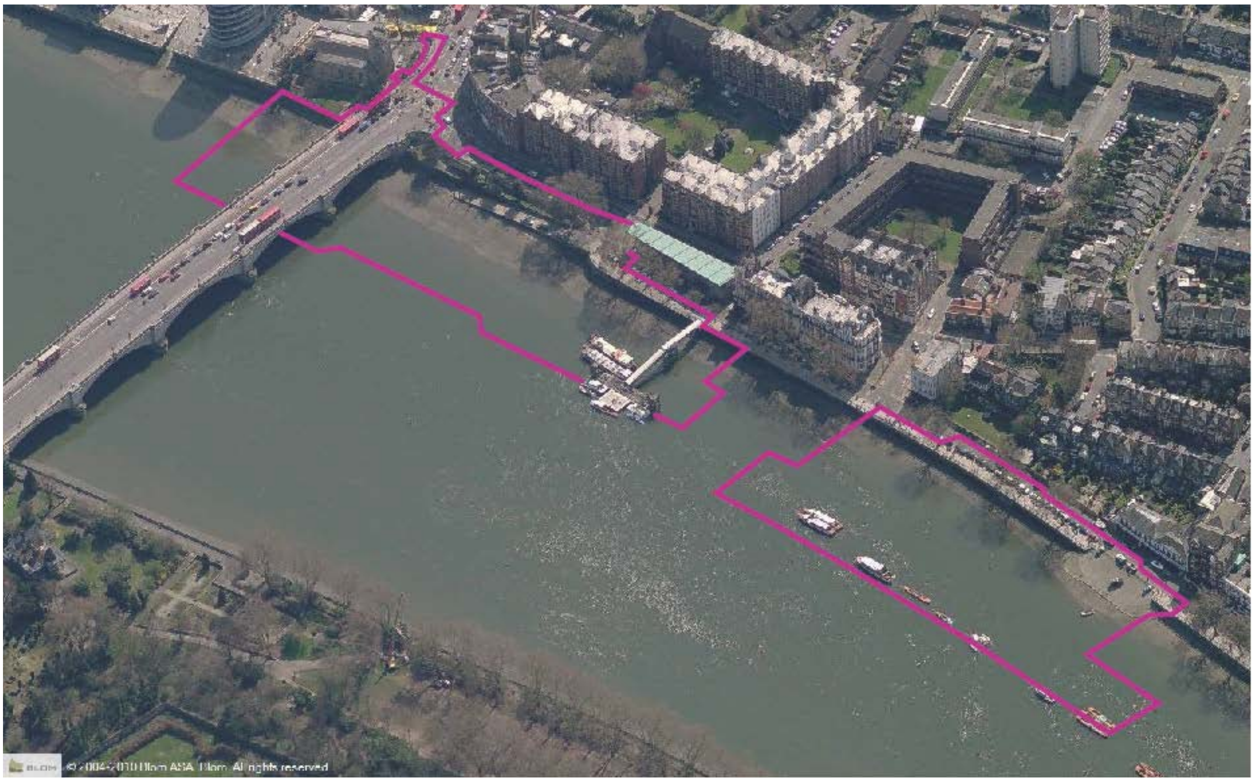


[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

9.1.3 The wider area includes residential, commercial and retail use, and includes Putney town centre. The nearest dwellings are to the south along the Embankment and Lower Richmond Road. Figure 9.1 to Figure 9.3 show the site and local context. Existing site access is via the Embankment carriageway.

9.1.4 Air quality management designations have been made by the London Borough of Wandsworth which covers the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

Figure 9.2 Aerial view of existing site



9.1.5 The areas of foreshore within the main site and the site for the temporary slipway fall within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation.

9.1.6 The southern end of the Grade II listed Putney Bridge falls within the main site. There are also several listed buildings in the vicinity of the main and secondary sites. These include: the Grade II* listed St Mary's Church; the Grade II listed White Lion Hotel; Winchester House (formerly the Putney Constitutional Club); and numbers 37, 39 and 41 Lower Richmond Road. The Star and Garter Public House, and Star and Garter Mansions, which are both locally listed buildings, are located across the Embankment to the southwest of the main site.

9.1.7 Both sites lie within the Wandsworth Thames Riverside Archaeological Priority Area (APA) and the Putney Embankment Conservation Area. There are no other environmental designations on or adjacent to the sites.

Figure 9.3 Putney Embankment Foreshore – site context

View from Putney Bridge east towards proposed development site showing slipway

View westwards towards proposed temporary slipway site

Existing screens underneath Grade II Putney Bridge

View from river towards Grade II* St. Mary's church

9.2 Proposed development

9.2.1 The purpose of the 2.8 hectare site (1.6 hectares for the main site and 1.2 for the temporary slipway site) would be to intercept the Putney Bridge combined sewer overflow which currently discharges untreated sewage into the River Thames on average 33 times each year, at a total volume of 68,000m^3. This is equivalent to approximately 27 Olympic sized swimming pools. Flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the main tunnel via a drop shaft. Once the existing sewer is intercepted and with flows diverted into the proposed main tunnel, there would be approximately one discharge of untreated sewage into the River Thames per year from this combined sewer overflow.

9.2.2 Construction at Putney Embankment Foreshore is assumed to start in 2016 and be completed by 2020. A shaft approximately 36 metres deep with an internal diameter of approximately six metres would be constructed within the river foreshore at the main site.

9.2.3 A temporary area of reclaimed land, called a cofferdam, would be constructed in the foreshore to enable a work site to be established and to enable the construction of the shaft and other structures. The cofferdam would be retained by steel piles or similar and built up to ensure that the site and surrounding area stay protected from flooding. The majority of the cofferdam area would be filled up to existing ground level so that the site is directly accessible to vehicles from the Embankment. The site area which extends beneath Putney Bridge would not be filled and would remain at the lower level of the existing foreshore.

9.2.4 Material used to fill in the cofferdam, and also excavated material arising from construction of the shaft and other structures would be transported by barges, minimising the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

9.2.5 Barges would be moored along the river face of the working area, whereby they would sit upon a flat granular bed, or campshed, during periods of low tide.

9.2.6 It is anticipated that one of the houseboats moored at Putney Pier would need to be temporarily relocated during the construction of the cofferdam.

9.2.7 The cofferdam at the main site would enclose the existing public slipway during construction and so it would be temporarily unavailable for use. A temporary slipway would be constructed and made available for public use before the commencement of construction at the main site. It would be located approximately 300 metres upstream of Putney Bridge and maintain access to the river whilst the existing public slipway is unavailable.

9.2.8 It is possible that either elevating / floating platforms, or jack up barges, would be used to construct the temporary slipway. Alternatively, the work would be conducted via inter-tidal working.

9.2.9 Appropriate traffic management and the provision of office and welfare facilities would be required to facilitate the construction of the temporary slipway. These would be situated upon the Embankment carriageway. A number of parking bays would be suspended to facilitate this.

9.2.10 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads with water to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles. During construction, vehicles would access the site via a new point adjacent to the junction of Lower Richmond Road and The Embankment carriageways. A short length of the existing one way system on The Embankment would be temporarily removed to allow construction vehicles to exit the site directly onto Lower Richmond Road. The average peak daily number of lorry trips at this site would be 21 and the average peak daily number of barges would be two.

9.2.11 A short period of 24 hour working would be required to build a short connection tunnel between the combined sewer overflow drop shaft and the main tunnel and also for secondary lining. During this period of continuous working, activities would be predominately below ground, with support activities occurring at ground level. Lorry movements would be limited to daytime hours.

9.2.12 The plan below (Figure 9.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which different components of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

9.2.13 Early design and layout included a shaft location closer to Putney Bridge but, following consultation, the shaft was moved to its proposed location to reduce impacts both on the Bridge and on the historic slipway.

9.2.14 To help explain this information, the schematic diagram below (Figure 9.5) illustrates where the structures may be located within these zones.

9.2.15 The majority of permanent works would be located within the foreshore of the River Thames and enclosed within a new foreshore structure. This structure would provide an operational area to facilitate vehicle access during maintenance activities. The structure would be finished at flood protection level to prevent the ingress of river water. This level would be above the existing carriageway level, with a series of tapered steps accommodating the level difference. The area would be hard landscaped upon completion and be accessible to the general public.

9.2.16 The interception chamber would be located beneath the arch of Putney Bridge. A temporary protective deck may be installed beneath the arch to prevent any damage to the listed bridge during the construction of the chamber. The main electrical and control kiosk would be located upon Waterman's Green and a secondary electrical and control kiosk would be located upon the permanent foreshore structure.

9.2.17 Whilst most of the structures would be underground, two 4 to 8 metre high ventilation columns would be required. One would be located on the new structure in the foreshore and the other on the eastern footway of Putney Bridge.

9.2.18 The height of the new ventilation columns, in combination with filters included in the belowground structures, would control odour and minimise any effect on surrounding residents. These are shown in an illustrative above ground plan in Figure 9.6.

9.2.19 Operational lighting of the foreshore structure would be minimal and would be designed to avoid light pollution and to respect the historic environment. No new lighting would be provided on Waterman's Green, except for a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

9.2.20 Once operational routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Operational access to the site would be off The Embankment carriageway.

Figure 9.4 Proposed development at the Putney Embankment Foreshore site

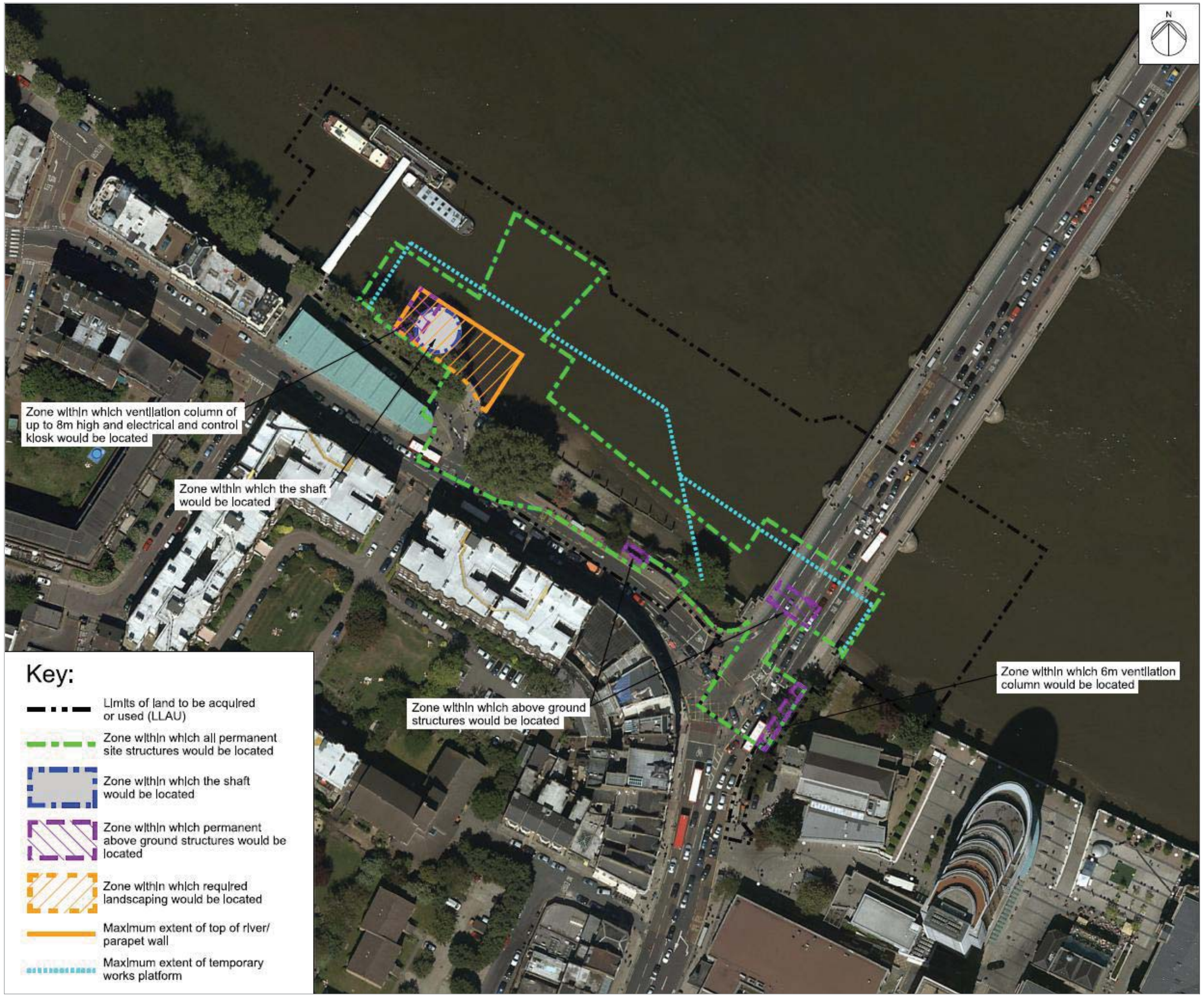


Figure 9.5 Schematic layout at the Putney Embankment Foreshore site

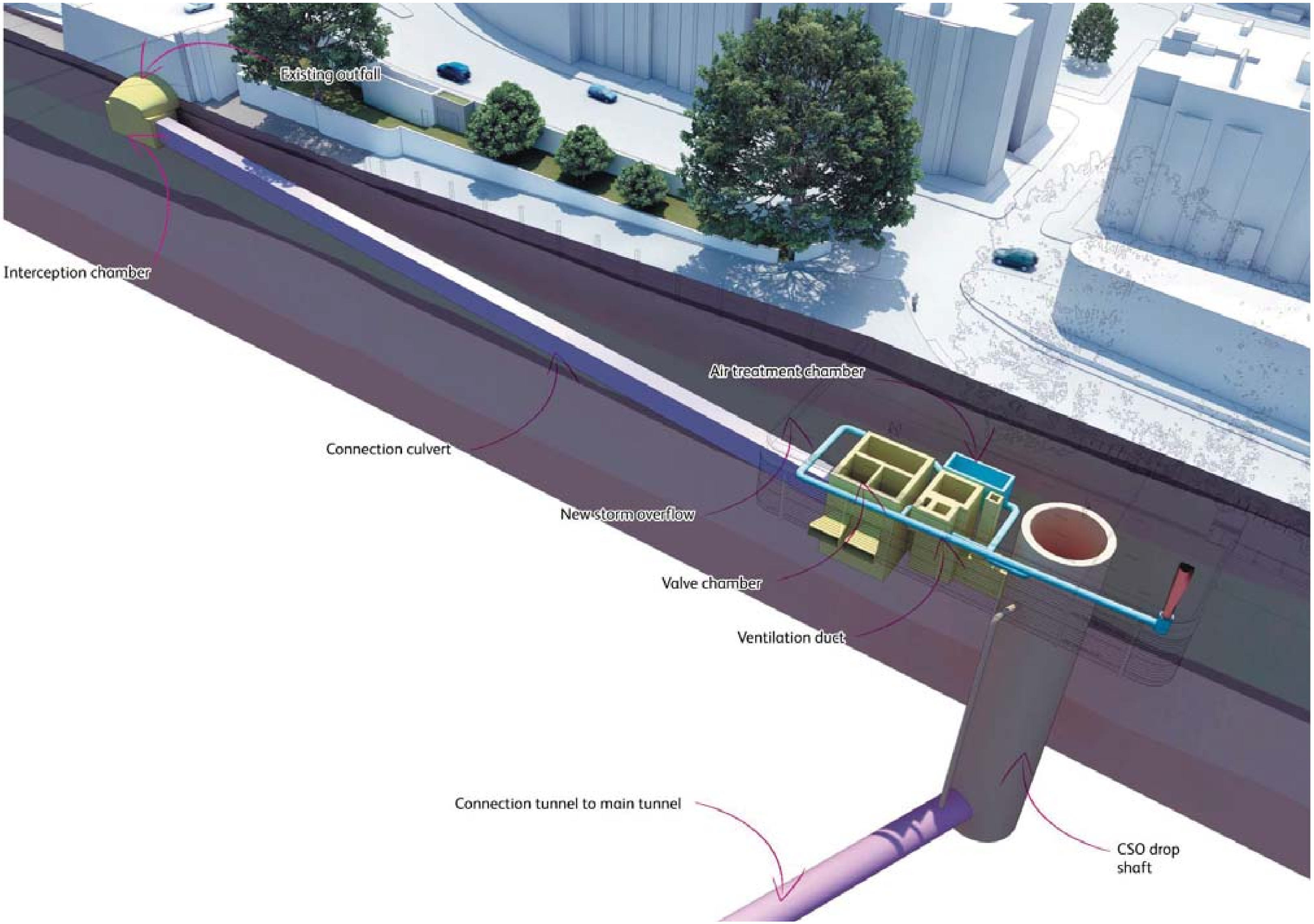


Figure 9.6 Putney Embankment Foreshore site – illustrative aerial view

9.3 Effects of the proposed development at Putney Embankment Foreshore on the environment

Introduction

9.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

9.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessment is given in Section 4 of the Non-Technical Summary with full details in Volume 2 of the *Environmental Statement.*

9.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Putney Embankment Foreshore site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the main tunnel is built and operational. The full details for each topic are contained in Volume 7 of the *Environmental Statement.*

Effects during construction

9.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tugboats (for river barges) that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties such as residents of Kenilworth Court (Figure 9.7) as well as users of recreational facilities, including the River Thames and the Thames Path. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect. This is due to the small increase in pollutant concentrations predicted.

Figure 9.7 Kenilworth Court residential dwellings

9.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

9.3.6 Noise could arise from construction activities including the movement of tugboats pulling river barges, construction traffic on roads accessing the site and noise from equipment used on site. In terms of noise effects from construction plant, the presence of hoarding around the site would help reduce noise. No significant noise effects from construction traffic (either road-based or river-based) are predicted due to small changes in traffic noise levels. However, noise from the construction site is likely to be significant adverse for two residential properties: 10 Ruvigny Gardens and Star & Garter Mansions (Figure 9.8) and public house staff accommodation. It is not possible to further reduce the effect through on site controls, but the residents of these properties may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme*.

9.3.7 Residents of the Putney Pier Houseboats would also experience significant adverse effects from noise. These properties may be eligible for temporary re-housing through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* as noise insulation would not be appropriate for houseboats. However it is recognised that the residents may not wish to take up this option, and as such significant adverse noise effects have been predicted.

Figure 9.8 View towards Star & Garter Mansions

9.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

9.3.9 In terms of townscape, there would be significant adverse effects on the character of the townscape of the site, and around the site along the River Thames and the Putney Embankment Conservation Area, and the character of Bishops Park on the opposite bank of the River Thames, due to construction activity. Beyond this, the character of the wider townscape is not predicted to experience significant effects due to the distance from the works and screening provided by Putney Bridge.

9.3.10 People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects, that is effects on their experience of views. Significant adverse effects have been identified on residents of Kenilworth Court on Embankment close to the site, and on recreational users of Putney Bridge and Embankment, and from locations on the opposite bank of the river. These effects are due to the visibility of construction activities. No other viewpoints are likely to experience significant effects due to construction works only being partially visible or in the background or periphery, filtered through trees and buildings, or due to distance.

9.3.11 Consideration of the amenity of local residents, businesses and users of the nearby River Thames and the Thames Path is provided in the assessment of socio-economics. This takes into account the findings of the noise, vibration, air quality, construction dust and visual effects on local amenity. Local café and restaurant businesses could be affected by a loss of custom should patrons be deterred from using them due to construction activity. However, businesses would be able to submit a claim for compensation under the *Thames Tideway Tunnel compensation programme* so this effect is not considered likely to be significant. Likely significant adverse effects have been identified on the amenity of those residents of nearby properties that would experience significant adverse noise and/or visual effects, as described above.

9.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of road users, pedestrians and cyclists would ensure that any significant transport effects are minimised. No significant effects on pedestrians, cyclists, river users or users of public transport are predicted (Figure 9.9). However significant adverse effects on parking are likely during the construction of the temporary slipway. A total of forty parking spaces would be temporarily suspended, in order to allow a safe pedestrian route and space for heavy goods vehicles to access the site.

Figure 9.9 Traffic crossing Putney Bridge

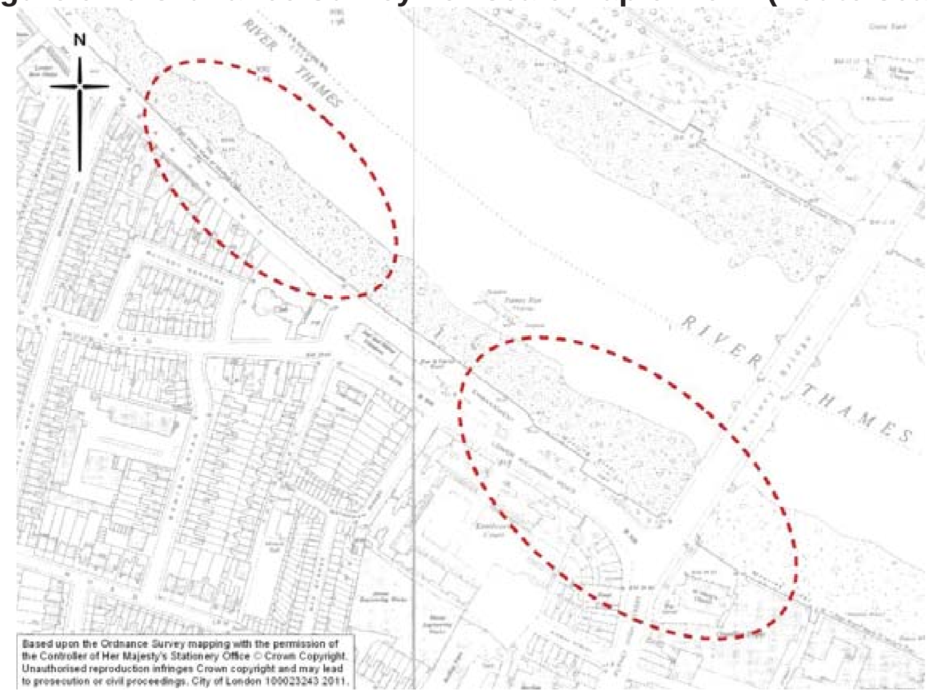
9.3.13 A study of historical maps, previous archaeological records and research into local history has been undertaken to build up a picture of the possible below ground remains. Construction work on site would involve changes to both above ground features as well as the environment below ground.

9.3.14 Information gathering has revealed some potential to contain later medieval artefacts and riverfront structures and high potential for post-medieval archaeology related to waterfront structures such as flood defences. There is low potential for archaeology of greater value, as natural erosion by the river and construction of the 19th century embankment is already likely to have removed remains from the foreshore. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

9.3.15 There are several above ground historic features at Putney Embankment Foreshore that would be affected by construction. There would be significant adverse effects on the setting of Putney Bridge and the character and appearance of the Putney Embankment Conservation Area due to the visibility of construction works. Effects on other listed buildings and conservation areas in the vicinity of the site would not be significant, due to the construction works only being partially visible or due to the distance of the works.

9.3.16 Below ground works could give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination (Figure 9.10). This may in turn affect construction workers and adjacent premises. The site and surrounding area has no history of contaminative land uses and the current land-use is unlikely to have caused contamination. Some contamination has been found in the foreshore part of the site from historic activities elsewhere along the Thames, but this poses a very low risk. Workers on site would have the necessary health and safety measures equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Given this approach, no significant effects have been identified. Measures to protect workers and the locals area from unexploded bombs would be applied as London heavily bombed during World War II. The application of these measures means there would be no significant effects.

Figure 9.10 Ordnance Survey 25" scale map of 1947 (not to scale)



9.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created, resulting in pollution. At the Putney Embankment Foreshore site measures such as bunded fuel stores to contain the risk of spills and also the treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

9.3.18 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. At the Putney Embankment Foreshore site a route for pollutants to enter the water may arise during the construction of the temporary cofferdam within the River Thames. This is because pollutants could be disturbed by excavation in the foreshore. Another route for pollutants could be from substances used in construction (for example oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants getting into the river in this way. Pollutants would either go into existing drains or be collected on site. Based on the application of these measures, no significant effects on surface water would occur.

9.3.19 The construction of the cofferdam in the foreshore of the River Thames at this location would lead to some changes in the flow of water in the river, which may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with appropriate protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

9.3.20 Flooding may occur from various sources for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river, groundwater and sewer flooding at the site. The proposed development could change the level of risk associated with all sources of flooding. However, the cofferdam would be constructed in the foreshore to the same height as the existing flood defence and the flood risk assessment for this site has found that there would be no change in flood risk as a result of construction works. Therefore there would be no significant effect in respect of flood risk.

9.3.21 The River Thames provides an important habitat for river ecology. The temporary landtake from habitats within the river from construction of the cofferdam and the campshed would be a small percentage of the total area of the River Thames and tributaries, which are designated for their nature conservation value. Given this, no significant effects on river habitats and associated species of plants and animals. There is also likely to be some disturbance of habitats and species due to barge movements, but as this would be over a limited area, no significant effects on aquatic ecology are predicted.

9.3.22 As described above, the presence of the cofferdam in the river would lead to some changes in the flow of water in the river. While this could affect the speed of flow and consequently could change the area over which sediments are deposited or existing sediments eroded, such localised changes are not likely to be significant.

9.3.23 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including noise control measures and avoiding direct lighting of the river. No significant adverse effects are therefore predicted.

9.3.24 The existing site and surrounding area on shore provides limited semi-natural habitat, including species-poor amenity grassland on Waterman’s Green and mature trees which offer some local value for wildlife. Bats are known to pass through the site, and some common birds may use the site for foraging and nesting, and wintering birds are also known to use the site. Construction would lead to a temporary loss of habitat for some species, and some low levels of disturbance due to noise and lighting. This is not predicted to give rise to significant effects.

9.3.25 The assessments have considered other developments that are planned nearby during the same timeframe that would interact with the construction work at the Putney Embankment Foreshore site. No significant cumulative effects have been identified.

Effects during operation

9.3.26 As stated in paragraph 9.2.17, the operational site would include two four to eight metre high ventilation columns would be required. One would be located on the new structure in the foreshore and the other on the eastern footway of Putney Bridge. Air treatment filters would also be installed to remove odour prior to release from the ventilation columns. The height of the ventilation columns would allow the elevated release of expelled air. This together with the filters would ensure there would be no significant effect from odour.

9.3.27 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

Figure 9.11 Recording background noise outside residences along Lower Richmond Road

9.3.28 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. Maintenance visits would require the suspension of a small number of parking bays, which would not give rise to significant effects.

9.3.29 Whilst the operational project at this site would have a permanent effect on the townscape character of the site and surrounding area due to the introduction of structures into the river, these effects are not likely to be significant. This is due to the proposed high quality design of the foreshore and above ground structures which would reflect the existing townscape character of the area. Effects on viewpoints are similarly not likely to be significant due to the high quality of the design. For some viewpoints effects are also minimised by the distance of the proposed development and/or screening provided by Putney Bridge, trees and buildings.

9.3.30 The inclusion of a well landscaped space in the operational development, in an area lacking in public open space, would be beneficial although not significant.

9.3.31 In terms of the setting of nearby heritage assets and conservation areas, given the high quality design of the operational development, the scale of the operational structures and, in some cases, the presence of intervening trees and buildings, no significant effects are likely.

Figure 9.12 View towards existing site (top photograph) and of site with foreshore structure in place (lower photomontage)

9.3.32 Groundwater levels and quality could theoretically be affected by seepage into, and out of the shaft. The risk of this would be low due to the way the shaft would be constructed. The presence of below ground structures may alter the local movement and level of groundwater. However, the assessment indicates that there would be no likely significant rise in groundwater levels related to the presence of the new structures.

9.3.33 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected. It would remove almost all the discharges, resulting in significant benefits to water quality.

9.3.34 The proposed permanent structures at this site have the potential to affect the movement of water within the river, and consequently deposition and erosion of sediments. However protective measures for any affected structures would be included in the operational development. No significant adverse effects are therefore predicted.

9.3.35 Associated with the improvement in water quality, would be significant beneficial effects on river based ecology (Figure 9.13). Sewage in the river leads to high levels of bacteria which remove oxygen from the water, leading to the death of fish. Reduced levels of sewage would mean this would happen far less often, resulting in a significant beneficial effect on fish populations. It is also likely that there would be significant beneficial effects from an increase in pollution sensitive fish species and an improvement in the quality of foraging habitat for fish.

9.3.36 The permanent loss of foreshore habitat would have a significant adverse effect on river habitats. To compensate for this, and other Thames Tideway Tunnel sites where permanent works in the river are proposed, a series of compensation measures have been developed. These include schemes to improve access to or creation of habitats elsewhere along the River Thames and its tidal tributaries.

Figure 9.13 Survey for river ecology at Putney Bridge foreshore

9.3.37 The fully built project would not alter the existing flood risk and the site, including the new operational structures on the foreshore, would be defended by new flood defences. Therefore the operational flood risk effects would not be significant.

9.3.38 No other developments are planned nearby that would interact with the operational project at the site and so no significant cumulative effects have been identified

9.3.39 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no likely significant effects in terms of contaminated land and therefore effects on these aspects of the environment were not assessed.

c. As operational activities would be limited at this site and would not lead to likely significant operational effects on land-based ecology, this was not assessed.

9.4 Further information

9.4.1 Further information regarding the assessment of the Putney Embankment Foreshore site can be found in Volume 7 of the *Environmental Statement*.

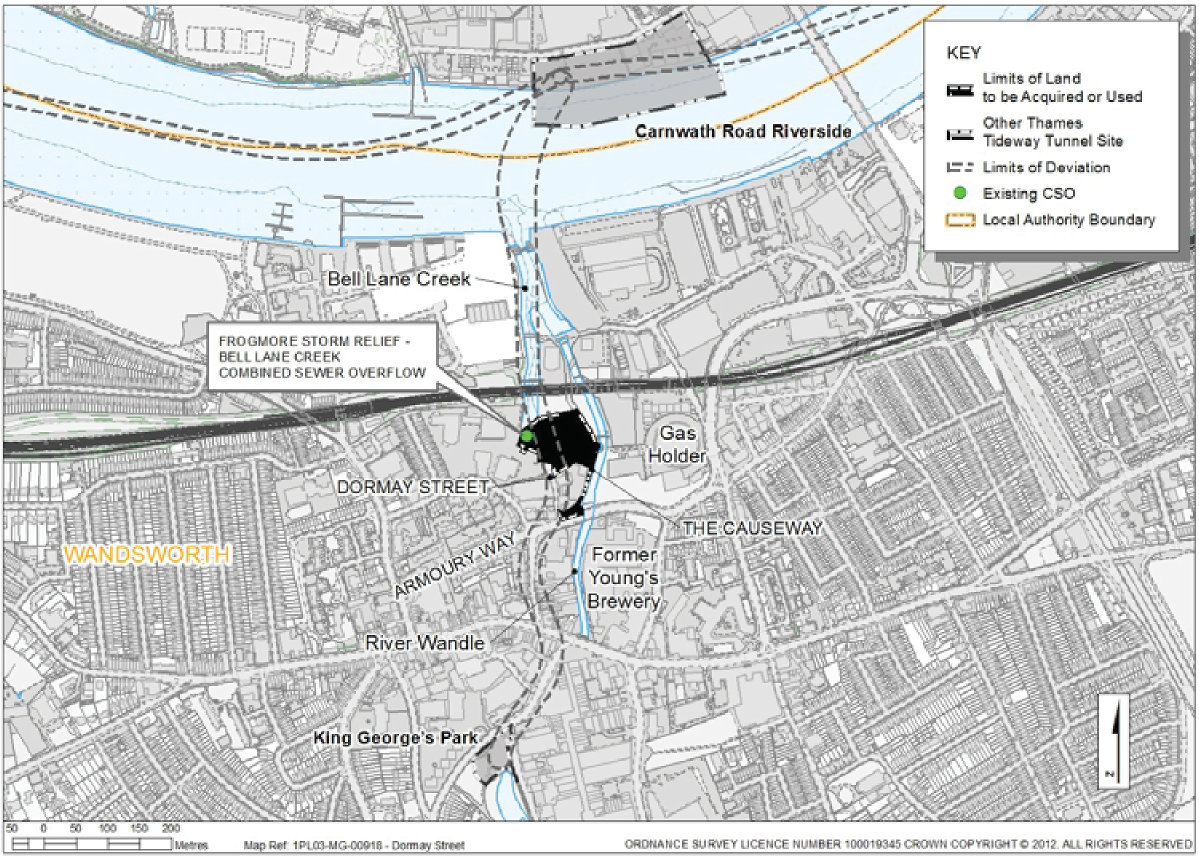
10 Dormay Street

10.1 Existing site context

10.1.1 The proposed development site at Dormay Street is located in the London Borough of Wandsworth. It comprises part of the Frogmore Industrial Complex and Causeway Island (including part of the Wandsworth Depot) as well as a section of The Causeway running down to the junction with Dormay Street and Armoury Way. Bell Lane Creek runs through the centre of the site.

10.1.2 The site is bounded by a vehicle storage area to the north, by the Lower River Wandle to the east, by a number of industrial buildings along Dormay Street to the south (including the Grade II listed Wentworth House), and by the Frogmore Industrial Complex to the west.

Figure 10.1[1] Location of proposed Dormay Street site



10.1.3 The surrounding area is a predominantly industrial and mixed-use. A public house, the Armoury, and a row of cottages and terraced properties are located further south at the junction of Dormay Street and Armoury Way. Figure 10.1 to Figure 10.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

10.1.4 Existing access to the site south of Bell Lane Creek is from Dormay Street. Access to Causeway Island to the north of Bell Lane Creek is via the Causeway. The site lies inland, approximately 300m from the River Thames.

Figure 10.2 Aerial view of existing site

10.1.5 An air quality management designation has been made by the London Borough of Wandsworth covering the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

10.1.6 The Bell Lane Creek, which runs through the centre of the site, is part of the River Thames and Tidal Tributaries Site of Importance for Nature Conservation. The Lower River Wandle adjacent to the eastern boundary of the site is also a designated Site of Importance for Nature Conservation.

10.1.7 The site lies within an Archaeological Priority Area designated by the London Borough of Wandsworth, which covers the River Thames and River Wandle floodplains. Part of the site is also located within the Wandsworth Town Conservation Area. There are no other environmental designations on or adjacent to the site.

Figure 10.3 Dormay Street – site context

Bell Lane Creek

Bell Lane Creek towards River Thames

Bell Lane Sluice

The Causeway

10.2 Proposed development

10.2.1 The purpose of this one hectare site would be to intercept a sewer overflow which currently discharges untreated sewage into the River Thames on average 32 times each year, at a total volume of 18,000m^3. This is equivalent to approximately seven Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, in most years there would be one discharge of untreated sewage into the River Thames from this combined sewer overflow.

10.2.2 At this site, flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the Frogmore connection tunnel via a drop shaft and then onto the Thames Tideway Tunnel.

10.2.3 Construction at the Dormay Street site is assumed to start in 2016 and be complete by 2019.

10.2.4 A shaft approximately 24 metres deep and with an internal diameter of approximately 12 metres would be constructed within the site to the north of Dormay Street.

10.2.5 The site would be used to facilitate the construction of the Frogmore connection tunnel between Dormay Street and Carnwath Road Riverside site to the north, and between Dormay Street and King George's Park site to the south.

10.2.6 The Frogmore connection tunnel would be built using a tunnel boring machine. The tunnelling machine for the Dormay Street to King George's Park site connection tunnel length would be lowered into the shaft at Dormay Street and, once underway, would travel southwards working 24-hours per day to help make sure that the work is completed safely, efficiently and in the least time. The tunnel boring machine would progressively excavate the ground and line the tunnel with precast concrete 'segments'.

10.2.7 The shaft at Dormay Street would be used to remove excavated material out of the tunnel as the tunnel boring machine progresses. It would also be used to delivery precast concrete 'segments' for the tunnel length under construction.

10.2.8 Once the tunnel length is completed, the tunnelling machine would be removed at the King George's Park site.

10.2.9 The above process would be repeated for the Dormay Street to Carnwath Road Riverside site connection tunnel length. Due to varying tunnelling requirements, different types of tunnel boring machine or tunnelling techniques may be used for each tunnel length.

10.2.10 The construction site would be split into two areas. The primary construction area would be located to the south of the Bell Lane Creek watercourse and would be the location of the shaft and other permanent structures. A secondary construction site would be located to the north of the watercourse and be used temporarily during construction only.

10.2.11 As this site is inland, deliveries for, and excavated material from, the construction of the shaft and other structures would be transported by road. Access would be via the existing access points to the Wandsworth Depot on The Causeway and Dormay Street although both access points would be relocated to the south slightly. The average peak daily number of lorry trips at this site would be 25. This peak would last for approximately four months.

10.2.12 The existing Causeway carriageway which crosses over the Bell Lane Creek has a weight limit and restricted width. A single span temporary bridge may therefore be built over the creek to connect the two parts of the site. Alternatively, the contractor may choose to transport materials over the creek in other ways, such as by using a crane.

10.2.13 Environmental controls would be in place throughout the construction phase to reduce potential impacts. This would include measures such as damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

10.2.14 A short period of 24 hour working would be required for the Frogmore connection tunnel and secondary lining works. During this period of continuous working, activities would be predominately below ground, with support activities occurring at ground level. Lorry movements would be limited to daytime hours.

10.2.15 Junction modifications may be required to the junction between Dormay Street and Armoury Way to accommodate lorries turning onto Armoury Way.

10.2.16 The plan below (Figure 10.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which different elements of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

10.2.17 To help explain this information, the schematic diagram below (Figure 10.5) illustrates where the structures may be located within these zones.

10.2.18 While most of the structures would be underground, an integrated ventilation structure and electrical and control kiosk would be built above ground. This would be located adjacent to the shaft on the southern side of Bell Lane Creek. A planted brown roof would be provided on the structure to promote local biodiversity. The structure would be between 4 and 6 metres in height.

10.2.19 A small diameter ventilation column serving the interception chamber would be located within the Wandsworth Depot area. This column would be approximately 6 metres in height.

10.2.20 The height of the structures, in combination with filters included in the below-ground structures, would control odour and minimise any effect on surrounding residents. These above-ground structures are shown in Figure 10.6.

10.2.21 Early design and site layout included the location of permanent above-ground structures in close proximity to the southern river wall of Bell Lane Creek. The position was amended to maintain a set back from the river wall and avoid jeopardising any opportunity for a new river walk / footway in the future if required.

10.2.22 The area immediately adjacent to the below ground structures would be finished in a hard landscape material to allow for operational maintenance activities. Once construction is complete, this area would be incorporated into the Wandsworth Depot area and be used for vehicle parking.

10.2.23 A series of bollards would prevent vehicles parking in close proximity to the integrated ventilation structure and electrical and control kiosk.

10.2.24 Final landscaping would incorporate the construction of an intertidal terrace in part of the southern river wall of Bell Lane Creek for environmental mitigation purposes.

10.2.25 Operational lighting would be the same as existing with the addition of a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

10.2.26 Once operational there would be routine inspections to the site every three to six months and major maintenance work carried out every ten years. Operational vehicle access to the site would be from the maintained construction access point on Dormay Street.

Figure 10.4 Proposed development at the Dormay Street site

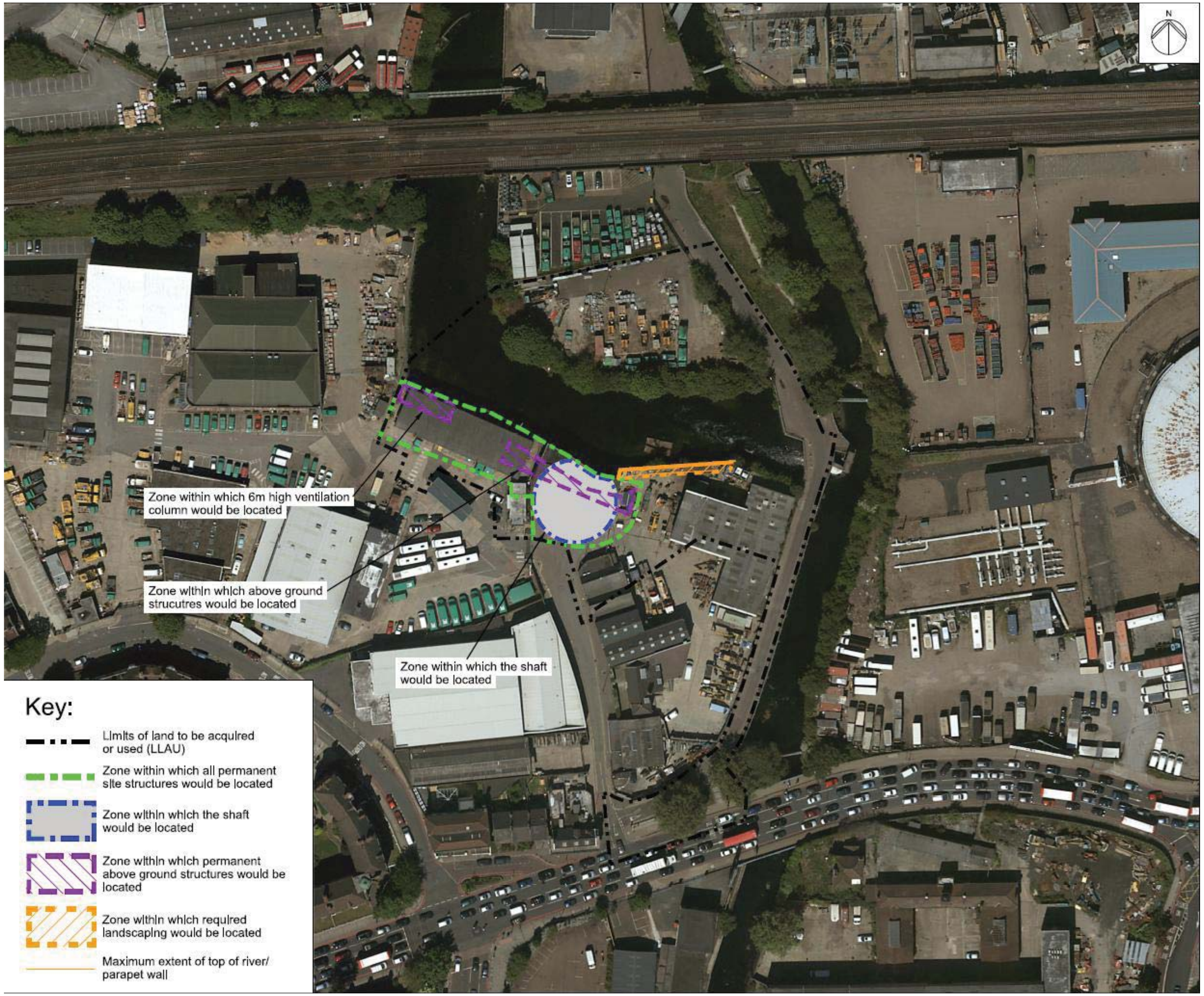


Figure 10.5 Schematic layout at the Dormay Street site

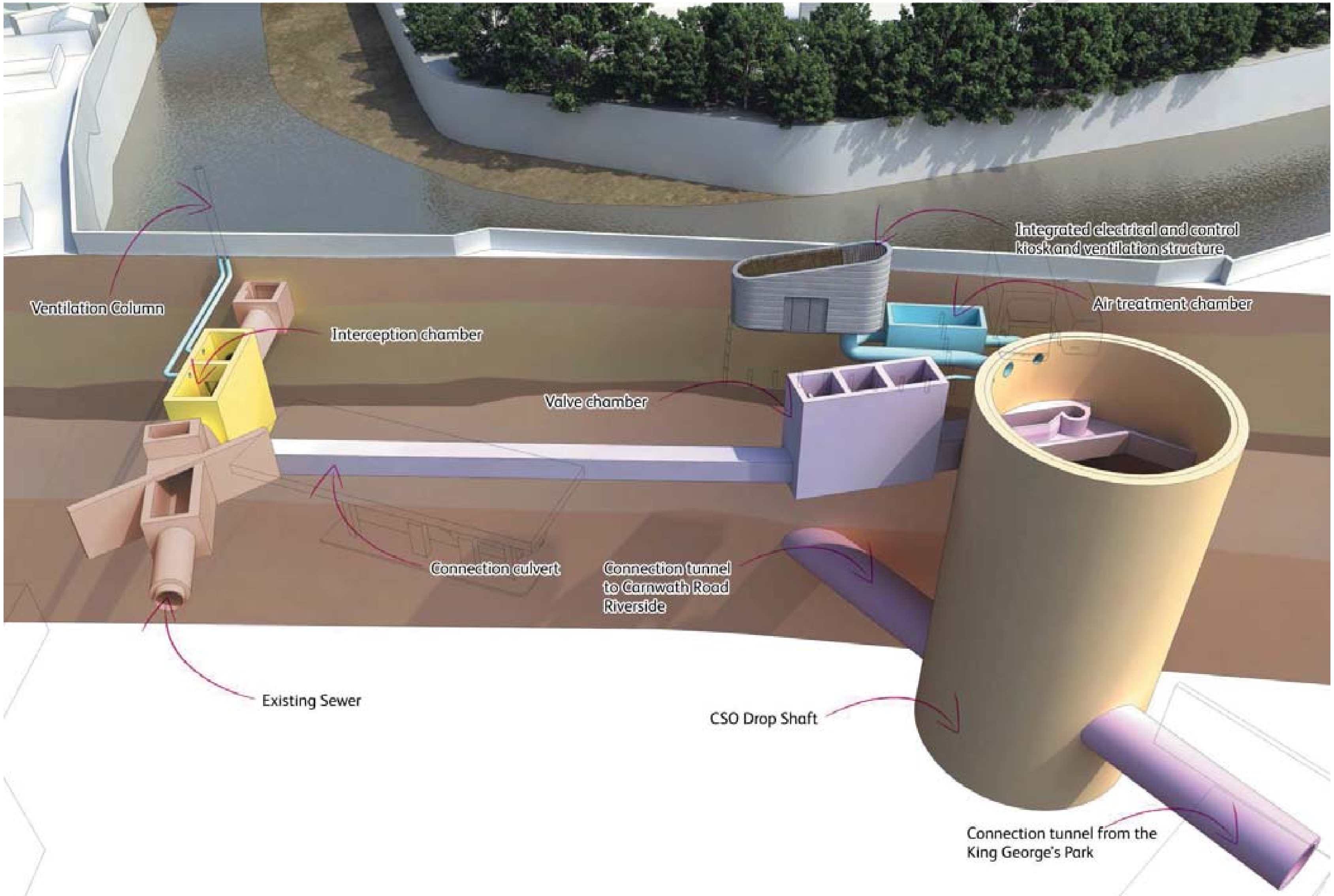


Figure 10.6 Dormay Street site – illustrative aerial view

10.3 Effects of the proposed development at Dormay Street on the environment

Introduction

10.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

10.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

10.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Dormay Street site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 8 of the *Environmental Statement*.

Effects during construction

10.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. This could affect local residents and other nearby sensitive properties. Pollutant levels are currently high across the London Borough of Wandsworth. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in any significant effects. This is due to the minor increase in pollutant concentrations predicted.

10.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be in place during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

10.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. The extra vehicles associated with the construction would result in a small increase to future traffic levels however this would not result in a significant increase in noise.

10.3.7 In terms of noise effects from construction plant, the site hoardings and the presence of industrial buildings in the vicinity of the site would help to screen noise from the majority of the works at nearby residential properties. These dwellings are also located quite a distance from the site. Whilst noise levels are expected to increase at the Frogmore Industrial Complex as a result of construction at the Dormay Street site, noise is not likely to exceed guidance levels, and the increase would therefore not be significant.

10.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

10.3.9 There are no significant townscape effects around the Dormay Street site, only minor alterations to the townscape character typical of a major engineering project including construction equipment such as cranes.

10.3.10 Significant adverse effects on views are predicted for recreational users along the Causeway and people travelling along Dormay Street towards the site. This is largely due to the removal of vegetation on Causeway Island, the presence of construction plant, site hoardings and the high visibility of construction traffic, as well as continuous lighting during the night. Further away, effects would not be significant because of reduced visibility of construction works.

10.3.11 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. It also considers local land uses such as the Wandsworth Depot (Figure 10.7) and Wandle Trail. As described above, likely visual significant effects were identified for viewpoints in relation to the Wandle Trail. However, given that visible construction activity would be consistent with the existing industrial character of the area, the effects on amenity would not be significant. Also, there are not predicted to be any significant socio-economic effects as a result of the reconfiguration of the Wandsworth

Depot, or the reduction in the availability of land used for employment purposes.

Figure 10.7 Wandsworth Depot Island site

10.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of road users, pedestrians and cyclists would ensure that no significant transport effects would occur.

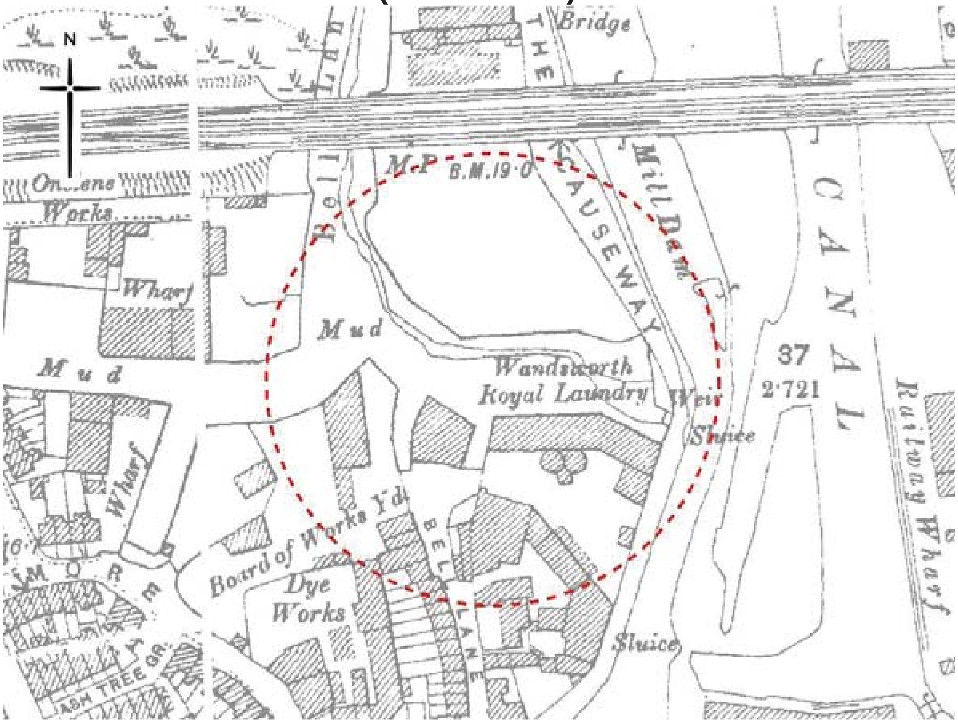
10.3.13 Construction work on site would involve changes to both above-ground features as well as the environment below ground. Both of these changes have the potential to affect historic assets.

10.3.14 Through a study of historical maps (Figure 10.8), previous archaeological records and research into local history, a picture of the possible below ground remains has been built up.

10.3.15 Information gathering has revealed that there is potential for prehistoric and medieval remains, prehistoric and Roman artefacts, and 18^{th}-19^{th} century industrial buildings. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

10.3.16 Above-ground features of some historic interest include the existing river wall on the south side of Bell Lane Creek and a19th century wall along the Causeway. Construction is not expected to have a significant effect on these assets. A 19^{th} or 20^{th} century campshed on the south side of Bell Lane Creek would be investigated prior to construction and, if required, a record of it prepared. This would ensure that any effects on this feature from river wall stabilisation works, the creation of the inter-tidal terrace and machinery in the creek would not be significant. In terms of setting, the small level of change predicted, and the presence of intervening structures, would not result in significant effects.

Figure 10.8 Ordnance Survey 2nd edition 25” scale map of 1896–8 (not to scale)



10.3.17 Below-ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The site has been subject to a number of potentially contaminative historical and current land uses such as a corporation/council depot and an electricity works. Fuel storage tanks (underground and above-ground) are known to be located on and immediately adjacent to the site. No likely significant effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects on construction workers, adjacent land-users, or the surrounding built environment.

10.3.18 Below-ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a ‘pathway’) is created, resulting in pollution. At this, measures such as bunded fuel stores to reduce the risk of spills and treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

10.3.19 Although the Dormay Street site lies inland, construction activity could affect water quality in the River Thames and Bell Lane Creek through rainfall carrying pollution from the site to the waterways. In addition there is potential for pollution to be washed into Bell Lane Creek from the surface of the bridge that may span across it. However, with the proposed site drainage and construction practices in place to minimise the risk of pollution, no significant effects are predicted.

10.3.20 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with sources of flooding. However, the finding of the flood risk assessment for the site is that there would be no change in flood risk during construction and therefore, there would be no significant effect in respect of flood risk.

10.3.21 The construction phase would lead to the temporary loss of intertidal habitats, increased areas of shade over Bell Lane Creek (Figure 10.9) due to the temporary installation of a bridge, potential pollution of habitats due to spillages from the bridge, loss of overhanging vegetation, and possible noise and vibration from works. However none of these potential impacts are likely to have a significant effect on river-based habitats or species.

Figure 10.9 Bell Lane Creek

10.3.22 A temporary loss of terrestrial habitat, including scattered trees and scrub, would occur but with vegetation reinstatement at the end of construction, no significant effects are predicted for habitats or notable species. There would be a permanent loss of a small area of vegetation, but as this is common habitat and of negligible value in ecological terms, it would not result in a significant effect. A brown roof would be installed on the integrated ventilation structure and electrical and control kiosk at the end of construction but this would represent a relatively small improvement and would not result in any significant effects. The small change in lighting on site during construction, the potential presence of a bridge over Bell Lane Creek, and the predicted levels of noise and vibration during construction are not likely to have a significant effect on the movement of bats or birds using the site.

10.3.23 The Wandsworth Riverside Quarter development would be under construction during the peak construction year at the Dormay Street site, and could affect the air quality and noise near the site. However, given the distance between the two sites, the effects on air quality would remain as assessed for the Thames Tideway Tunnel project. Similarly, whilst noise from the construction of the Wandsworth Riverside Quarter development is likely to affect Enterprise Way, the construction works at Dormay Street site are not, and therefore there would not be cumulative noise effects on that area. In addition, the transport assessment uses a model that accounts for traffic increases associated with construction of developments at Battersea Reach and the Wandsworth Riverside Quarter. On this basis, no additional cumulative assessment is required. The development at Wandsworth Riverside Quarter would not give rise to cumulative effects on amenity, the functioning of Wandsworth Depot, or in respect to employment land, and therefore socio-economic effects would remain as assessed for the Thames Tideway Tunnel project.

Effects during operation

10.3.24 The operation of the Dormay Street site would include a ventilation structure that contains air treatment filters to remove odour prior to release from the 6 metre high ventilation column. It has been predicted that there would be no detectable odour either on or off the site, and as such there would be no significant effect from odour.

10.3.25 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

10.3.26 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes could cause a short-term delay to other road users while vehicles manoeuvre into the site, and space within the site would be required to locate them. This infrequent operational activity would not lead to significant effects.

10.3.27 The permanent structures, areas of hardstanding and the creation of intertidal terrace would permanently reduce the amount of land that can be used for employment purposes. However, this loss would be relatively small compared to the amount of employment land available in the borough, and a large proportion of the operational site can be utilised for car parking by workers at the Wandsworth Depot. As such there would not be a significant effect on socio-economics due to the operation of the site at Dormay Street.

Figure 10.10 View towards Wandsworth Depot

10.3.28 The settings of a 19th century wall along The Causeway, Wandsworth Town Conservation Area, Grade II Wentworth House and the Armoury public house would be enhanced as a result of improvements in the architectural quality of the settings and the expansion of views. However, as these improvements are considered relatively minor, the effect would not be significant.

10.3.29 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

10.3.30 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

10.3.31 The effect of the project at this site would be to substantially reduce flows of sewage into Bell Lane Creek and the River Thames from the discharge point to which the site is connected, with one discharge in a typical year, resulting in significant benefits to water quality.

10.3.32 Associated with the improvement in water quality, would be significant beneficial effects on river-based ecology. Fish would benefit from the reduced pollution and improved foraging habitat, leading to a general increase in numbers and species diversity. In addition, the creation of an area of new intertidal habitat would have a significant beneficial effect on habitats and fish.

10.3.33 No other developments are planned nearby that would interact with the operation of the project at the site and so no significant cumulative effects have been identified.

10.3.34 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Townscape and visual effects during operation have not been assessed on the basis that the site would comprise new high quality and low level above-ground structures, a strengthened river wall including a terrace, and hardstanding within an industrial compound. It is considered that this would not result in any significant effects.

c. A number of design measures would be included to prevent any contamination related to the operation of the Thames Tideway Tunnel that could impact on construction workers, adjacent land users, or the surrounding built environment. For this reason no significant effects are anticipated, and therefore land quality effects during operation have not been assessed.

d. Given the infrequent maintenance requirements and the fact that the design would involve minimal operational lighting, significant effects on land based ecology are not likely, and therefore were not assessed.

10.4 Further information

10.4.1 Further information regarding the assessment of the Dormay Street site can be found in Volume 8 of the *Environmental Statement*.

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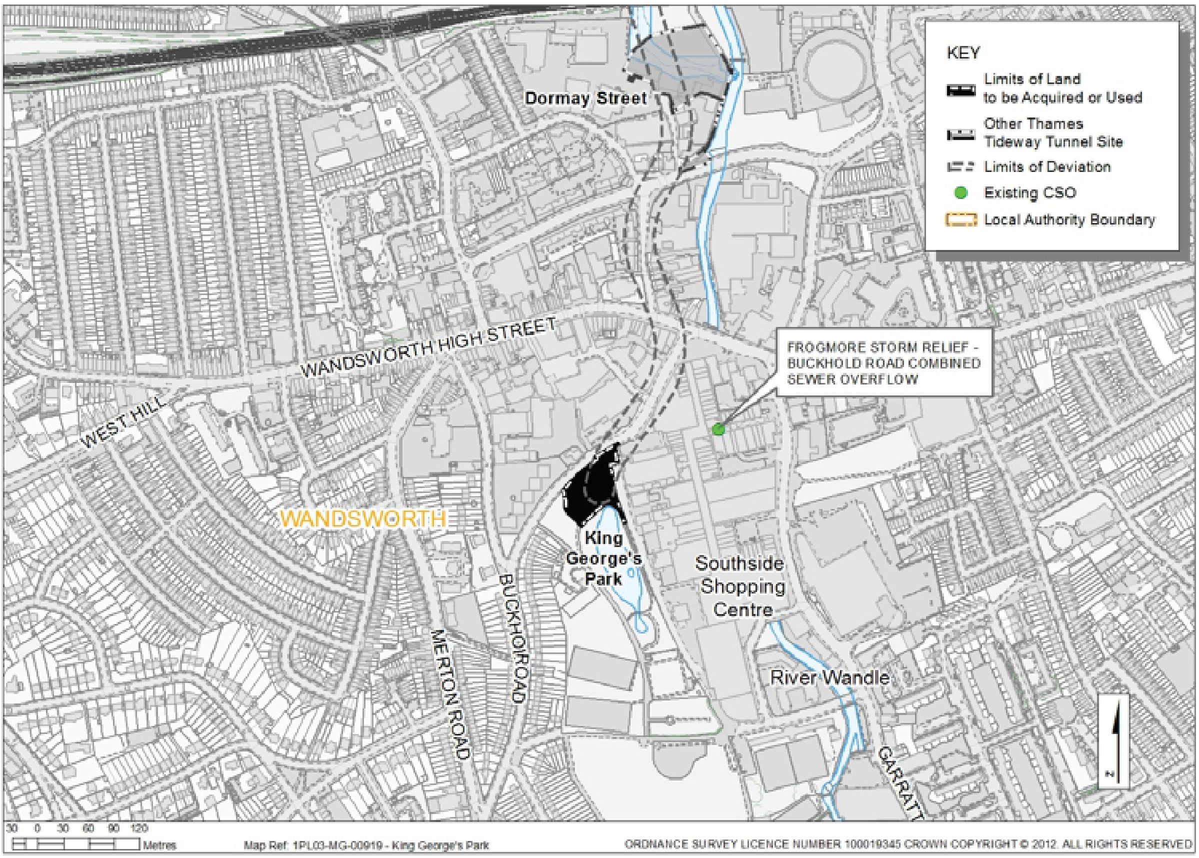
11 King George's Park

11.1 Existing site context

11.1.1 King George's Park is located in the London Borough of Wandsworth. The proposed development site encompasses the northern end of King George's Park adjacent to the entrance from Buckhold Road and the junction of Buckhold Road and Neville Gill Close.

11.1.2 The site is bounded by Neville Gill Close and Southfields Shopping Centre car park to the east, Buckhold Road to the north and west, and the main body of King George's Park to the south.

Figure 11.1[1] Location of proposed King George's Park site

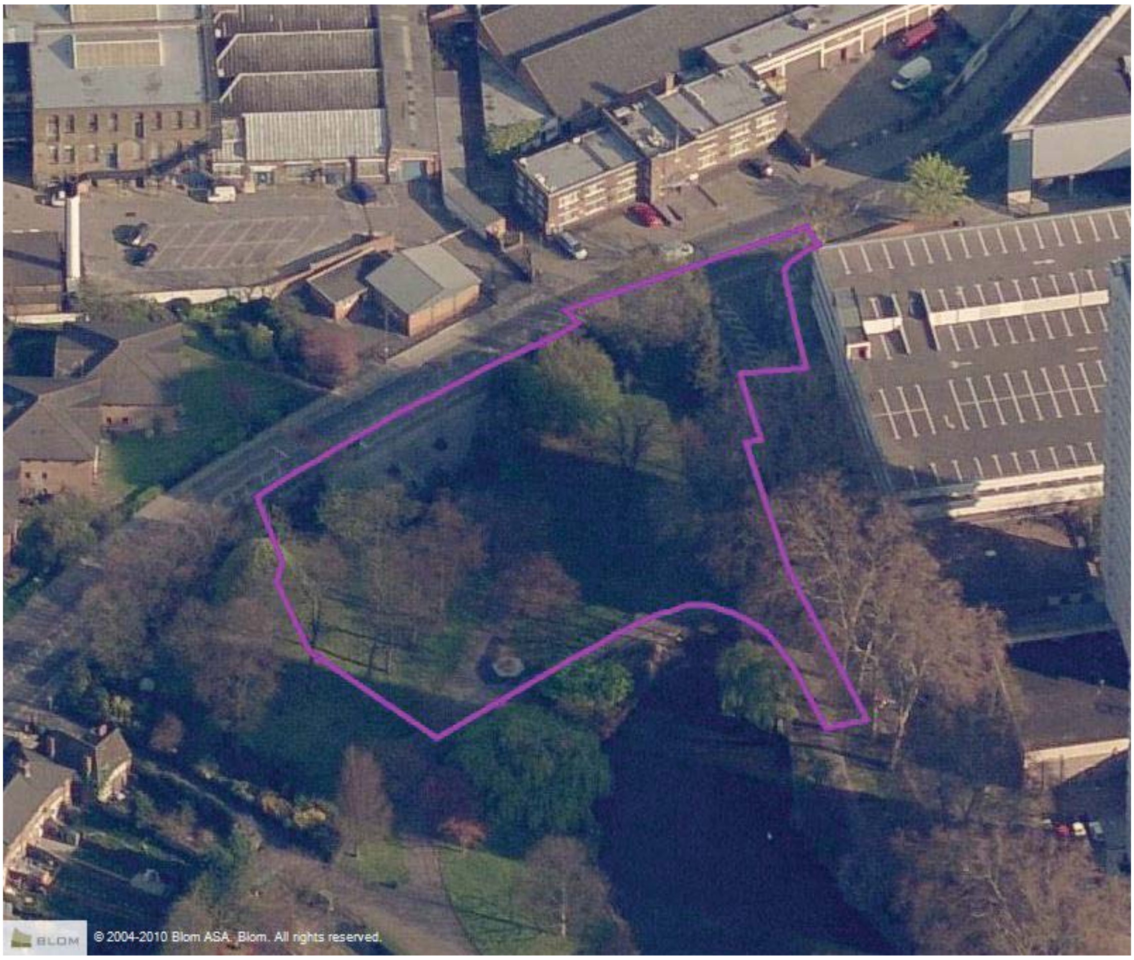


11.1.3 The surrounding area is mixed use comprising open space and residential and commercial properties. The nearest dwellings are to the west of the site on Buckhold Road. Figure 11.1 to Figure 11.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

11.1.4 Existing access to the site is via various pedestrian park entrances. There is no vehicular access. The site lies inland, approximately 800m from the River Thames.

Figure 11.2 Aerial view of existing site



11.1.5 Air quality management designations have been made by the London Borough of Wandsworth covering the whole borough. These designations are made where pollutant levels (mainly from road vehicles) are above set standards.

11.1.6 The site is located within King George's Park which is a designated Site of Importance for Nature Conservation. There are no other environmental designations on or adjacent to the site.

Figure 11.3 King George's Park – site context

View towards site

Path within King George's Park

Lake within King George's Park

Mature tree near to Neville Gill Close

11.2 Proposed development

11.2.1 The purpose of this 0.4 hectare site would be to intercept a sewer overflow which currently discharges untreated sewage into the River Thames on average 21 times each year, at a total volume of 86,000m^3. This is equivalent to approximately 34 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, in most years there would be one discharge of untreated sewage into the River Thames from this combined sewer overflow.

11.2.2 At the site, flows would be transferred from the relatively shallow depth of the existing pipework to the Frogmore connection tunnel via a drop shaft and then onto the Thames Tideway Tunnel.

11.2.3 During construction, the King George's Park site would be utilised to receive the tunnelling machine used to construct the Frogmore connection tunnel driven from the Dormay Street site. The machine would be lifted out of the shaft by a heavy lift mobile crane before being cleaned and disassembled at ground level. The components would then be removed off site via road.

11.2.4 Construction at King George's Park is assumed to start in 2017 and be completed by 2019. Before construction activity begins, there would be tree planting to the south of the site. This would assist in providing visual screening of the construction activities when viewed from the south.

11.2.5 A shaft of approximately 21 metres deep with an internal diameter of approximately nine metres would be constructed in the northern region of King George's Park. Early design had the shaft nearer to the western perimeter of the park, close to the existing Buckhold Road entrance. However, feedback received from stakeholders promoted the moving of the shaft to reduce the impact on green space and the local environment. The moving of the shaft also minimised the amount permanent hardstanding required to provide safe operational access.

11.2.6 A new access point with appropriate traffic management measures would be created off Neville Gill Close. As this site is inland, materials would be transported to and from the site by road, rather than by barge on the river. The average peak daily number of lorry trips at this site would be eight.

11.2.7 Minor kerb modification may be required at the junction of Buckhold Road and Neville Gill Close to enable lorries to negotiate the turn.

11.2.8 Environmental controls would be in place throughout the construction phase. This would include measures such as damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

11.2.9 The plan below (Figure 11.4) shows the layout of the proposed development for which consent is sought. The plan shows a series of zones within which different aspects of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

11.2.10 To help explain this information, the schematic diagram below (Figure 11.5) illustrates where the structures may be located within these zones.

11.2.11 The area adjacent to the below ground structures would be finished in a hard landscape material to facilitate safe operational access. There would be a level difference between the existing park and the elevated operational hardstanding area. This would be achieved by a slope, seating or steps.

11.2.12 The final landscaping would have a shallow depression for flood mitigation purposes. This would be located towards the east of the operational access area and would be finished in grass to provide a natural appearance.

11.2.13 While most of the structures would be underground, a 3 metre high above ground ventilation structure and electrical and control kiosk would be built. A planted brown roof would enclose the structure to promote local biodiversity. Two ventilation columns would be constructed on the elevated operational hard standing area. The ventilation column serving the shaft would be between 4 and 8 metres high and the ventilation column serving the interception chamber would be 6 metres in height.

11.2.14 The height of the two new ventilation columns, in combination with filters included in the design, would control odour and minimise any effect on surrounding residents and park users. The above ground structures are illustrated in Figure 11.6.

11.2.15 The amount of soft landscaping within the site boundary would be maximised. The existing avenue of trees on the eastern edge of the park that terminates at the north end, with a black poplar tree, would be retained. The John Young tree and memorial bench would be protected during construction and be retained in their current position in the final design.

11.2.16 Low level operational lighting would be provided in the elevated hardstanding area and would be designed to avoid light pollution. There would also be a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

11.2.17 Once operational, routine inspections would be made every three to six months and important maintenance work carried out every ten years. Operational vehicle access to the site would be via the proposed access on Neville Gill Close.

Figure 11.4 Proposed development at the King George's Park site

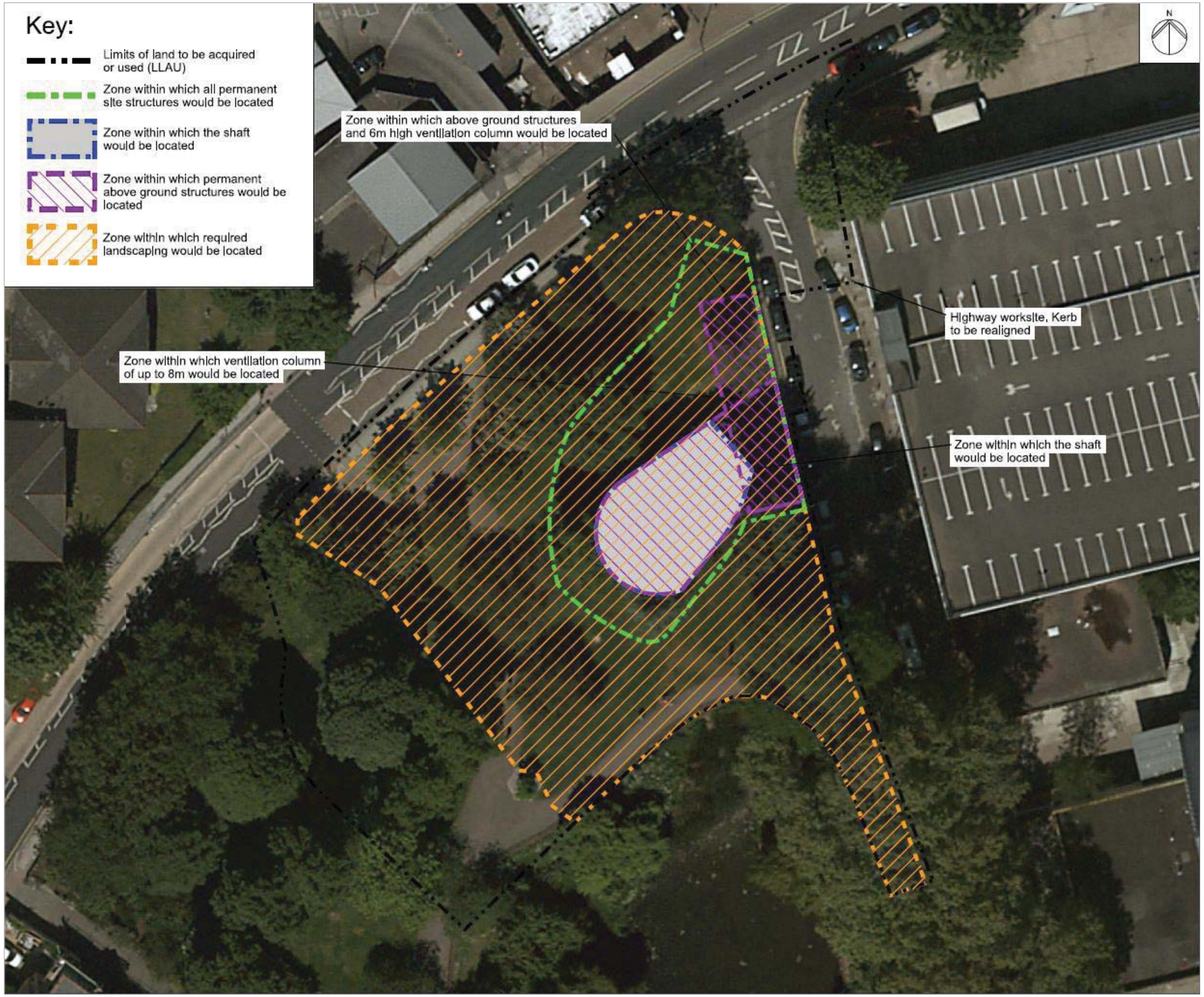


Figure 11.5 Schematic layout at the King George's Park site

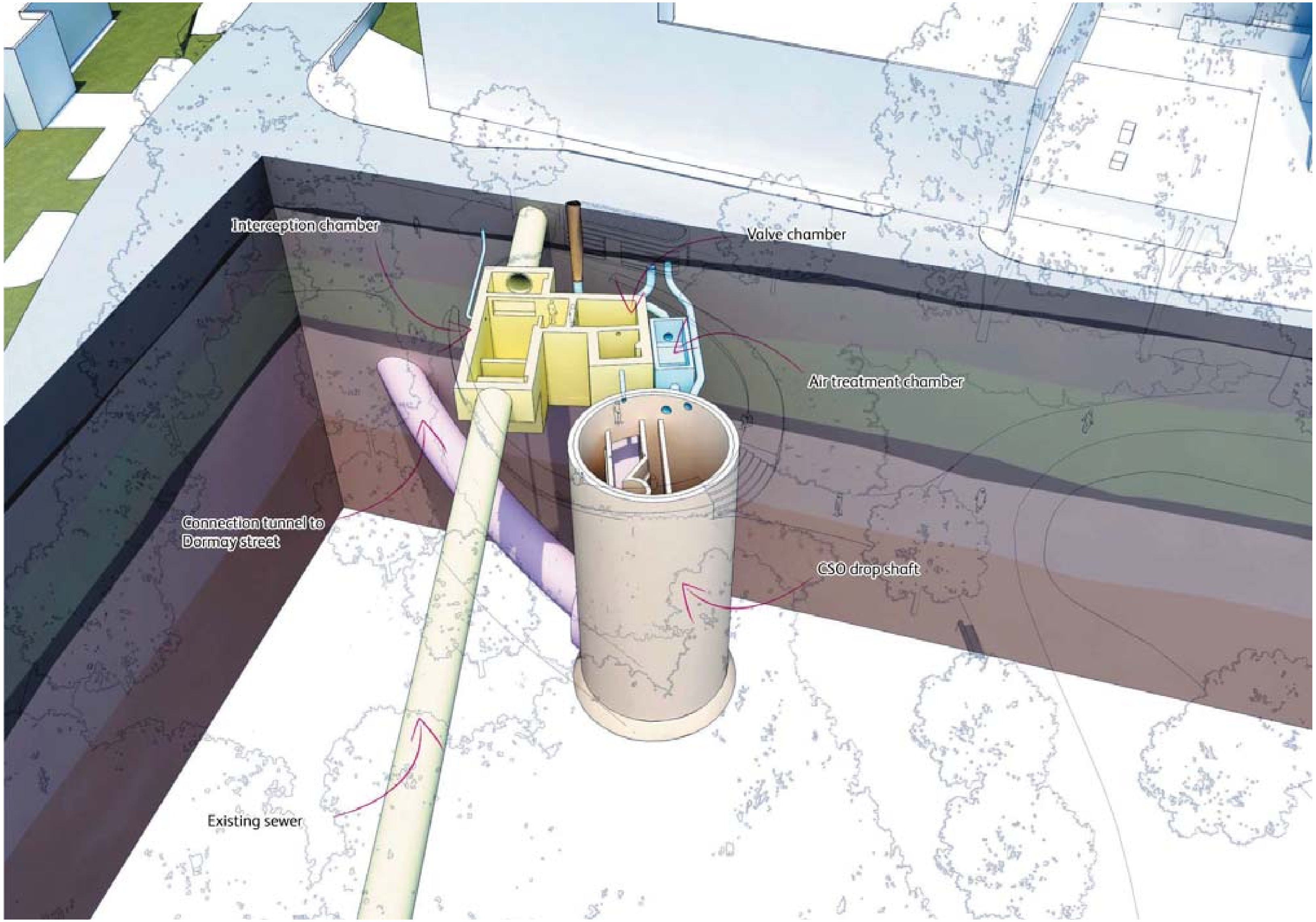


Figure 11.6 King George's Park site – illustrative aerial view

11.3 Effects of the proposed development at King George's Park on the environment

Introduction

11.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

11.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement.*

11.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the King George's Park site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 9 of the *Environmental Statement*.

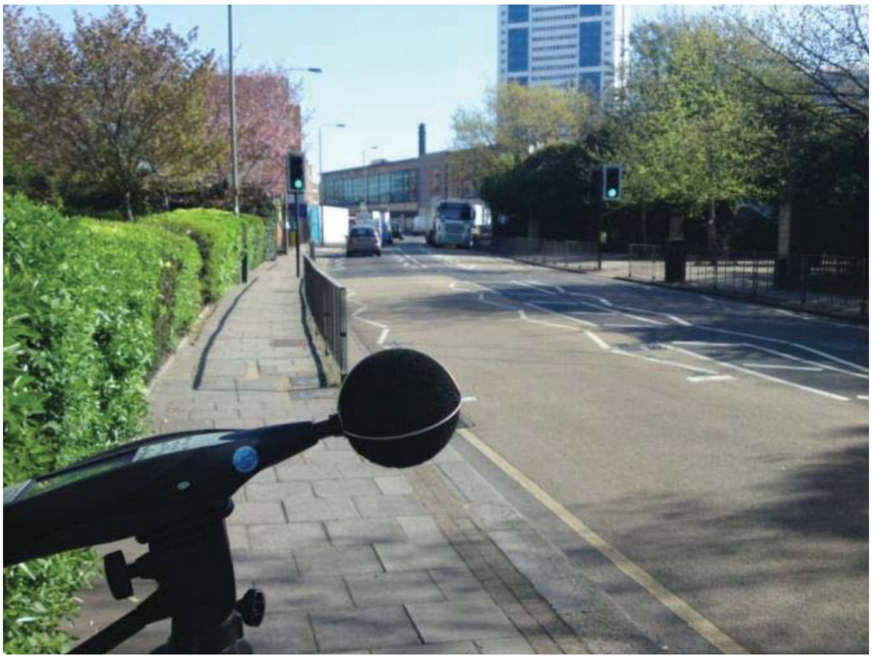
Effects during construction

11.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties and users of King George's Park. Pollutant levels are currently high across the London Borough of Wandsworth. However, based on computer modelling, it is predicted that pollutants associated with construction works at this site would not result in any significant effects. This is due to the small increase in pollutant concentrations predicted.

11.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

11.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. There would not be any significant noise effects from construction traffic due to the small changes in traffic noise levels predicted. In terms of noise effects from construction plant, with control measures in place, effects from construction would not be significant.

Figure 11.7 Recording background noise along Buckhold Road, outside King George's Park



11.3.7 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

11.3.8 The proposals at this site include planting trees in advance of construction to help screen construction equipment. Nevertheless a significant adverse effect is predicted on the townscape character of the site and the wider character of the park due to the removal of mature trees and the presence of site hoardings and construction activity. The wider townscape character beyond the park would not be significantly affected due to distance from the site and/or screening provided by buildings and vegetation.

11.3.9 People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects (effects on their experience of views). Significant adverse effects are predicted for views from properties in Buckhold Road; this is due to the visibility into the site and the presence of construction plant. Significant adverse effects are also predicted on views from recreational locations, including the Chinese Bridge in King George's Park, the lakeside footpath, and on views for those travelling along Neville Gill Close. Further away from the site and location of the works, effects would not be significant. For example, the effect on the view from the Fosters Walk entrance to the park, with only partial views of construction activity due to screening by the advance planting, is not likely to be significant.

Figure 11.8 Area of the proposed site within King George's Park

11.3.10 Consideration of the amenity of local residents and users of King George's Park, children's play facilities and community facilities (for example, the Penfold Day Centre) are provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. As described above, likely significant adverse effects were identified for some viewpoints, however, when considered in the context of the overall experience of amenity, it was concluded that effects on amenity would not be significant.

11.3.11 The measures proposed as part of the project to minimise disruption and ensure the safety of road users, pedestrians and cyclists would ensure that there are no significant transport effects.

Figure 11.9 Existing view along Neville Gill Close

11.3.12 Through a study of historical maps previous archaeological records and research into local history, a picture of the possible below ground remains has been built up (Figure 11.10). Construction work on site would involve changes to both above ground features as well as the environment below ground.

11.3.13 Information gathering has revealed that there is potential for remains from prehistoric settlement and from post-medieval remains, such as drainage ditches and buried park landscape features. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

Figure 11.10 King George's Park – Stanford's map of 1862

11.3.14 Above ground features of interest include the ornamental gateway to, and railings around, King George's Park, as well as the park itself. The historic entrance to the park on Buckhold Road (Figure 11.11) along with a section of railings would be removed. These would be relocated elsewhere, subject to agreement with the local authority and would be documented before removal. Therefore, there would be no significant effect on historical features above ground.

Figure 11.11 Northern gate of King George's Park

11.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. However, no contaminating uses have been identified within or around the site and workers on site would in any case have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would also be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

11.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created, resulting in pollution. At the King George's Park site, measures such as bunded fuel stores to reduce the risk of spills and treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

11.3.17 Construction at the King George's Park site could affect surface water quality in the River Wandle and Graveney, and the lake in King George's Park, through rainfall carrying pollution from the site. However, with the proposed site drainage and construction practices in place to minimise the risk of pollution, no significant effects are predicted.

11.3.18 Flooding may occur from various sources for example tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of river-sourced, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, the finding of the flood risk assessment and detailed river modelling for the site is that there would be no change in risk between the existing and future situation that would occur during construction. Therefore there is no significant effect in respect of flood risk.

11.3.19 Construction effects would only occur for river based ecology where construction activities take place in-river. As this site is inland there would be no likely significant effects.

11.3.20 The King George's Park site is an area of semi-natural habitat, which includes amenity grassland, scattered trees and shrub planting. This is of some ecological value in an otherwise urban area, and it is designated as a borough level site of importance for nature conservation. The site and surrounding area provide habitats for a number of species including bats and birds. During construction, control measures would be in place such as noise screening and measures to minimise light spillage which would minimise the disturbance of these species. The effects on species that use the site and immediate surrounds, including birds and bats would therefore be minimal. On this basis, there would be no significant effects on terrestrial ecology.

Figure 11.12 Existing vegetation within King George's Park

11.3.21 There would be advance planting of trees prior to construction and reinstatement of habitat at the end of construction. These changes would be relatively small and are considered not significant in ecological terms.

11.3.22 The topic assessments have considered other developments that are planned nearby during the same timeframe that would interact with the construction work at the King George's Park site. No significant cumulative effects have been identified.

Effects during operation

11.3.23 The operational site would include two ventilation columns of eight metres and six metres in height, into which air treatment filters would be installed to remove odour prior to release. The height of the ventilation columns would allow the elevated release of expelled air and therefore there would be no significant effect from odour.

11.3.24 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Any noise generated by other plant equipment would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground and a number of structures provide a barrier to noise and vibration, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

11.3.25 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term temporary parking restrictions on Neville Gill Close to allow safe access to the site. This infrequent operational activity would not lead to significant effects.

11.3.26 The project would have beneficial effects on the townscape character of the site and surrounding area, through the introduction of new tree planting and high quality public space. However, the effects would not be significant. Most viewpoints would experience no significant effects. The visibility of the newly planted trees and high quality new landscaped area would however result in a significant beneficial effect on the view from the lakeside footpath in King George's Park.

11.3.27 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

11.3.28 The fully built project would include a landscaped depression area to facilitate the movement of fluvial floodwater. The detailed river modelling undertaken for this site shows that with this measure in place project would not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

11.3.29 The effect of the proposals at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected, with only one discharge in a typical year, resulting in significant benefits to water quality.

11.3.30 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology. Fish would benefit significantly from a reduced occurrence of low oxygen levels and improved foraging habitat. In addition there is likely to be an increase in the distribution of species which are sensitive to pollution.

11.3.31 No other developments are planned nearby that would interact with the operation of the project at the site and so no significant cumulative effects have been identified.

11.3.32 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Land quality risks at the site are low. Furthermore a number of design measures would be included to prevent any contamination related to the operation of the Thames Tideway Tunnel. On this basis land quality effects during operation have not been assessed.

c. Operational activities would have no effect on aspects of historical interest, below or above ground, and therefore effects on the historic environment have not been assessed.

d. Given the infrequent maintenance requirements and the fact that the design would involve minimal operational lighting, significant effects on land based ecology are not likely, and therefore have not been assessed.

Figure 11.13 Location of facilities near to King George's Park

11.4 Further information

11.4.1 Further information regarding the assessment of the King George's Park site can be found in Volume 9 of the *Environmental Statement*.

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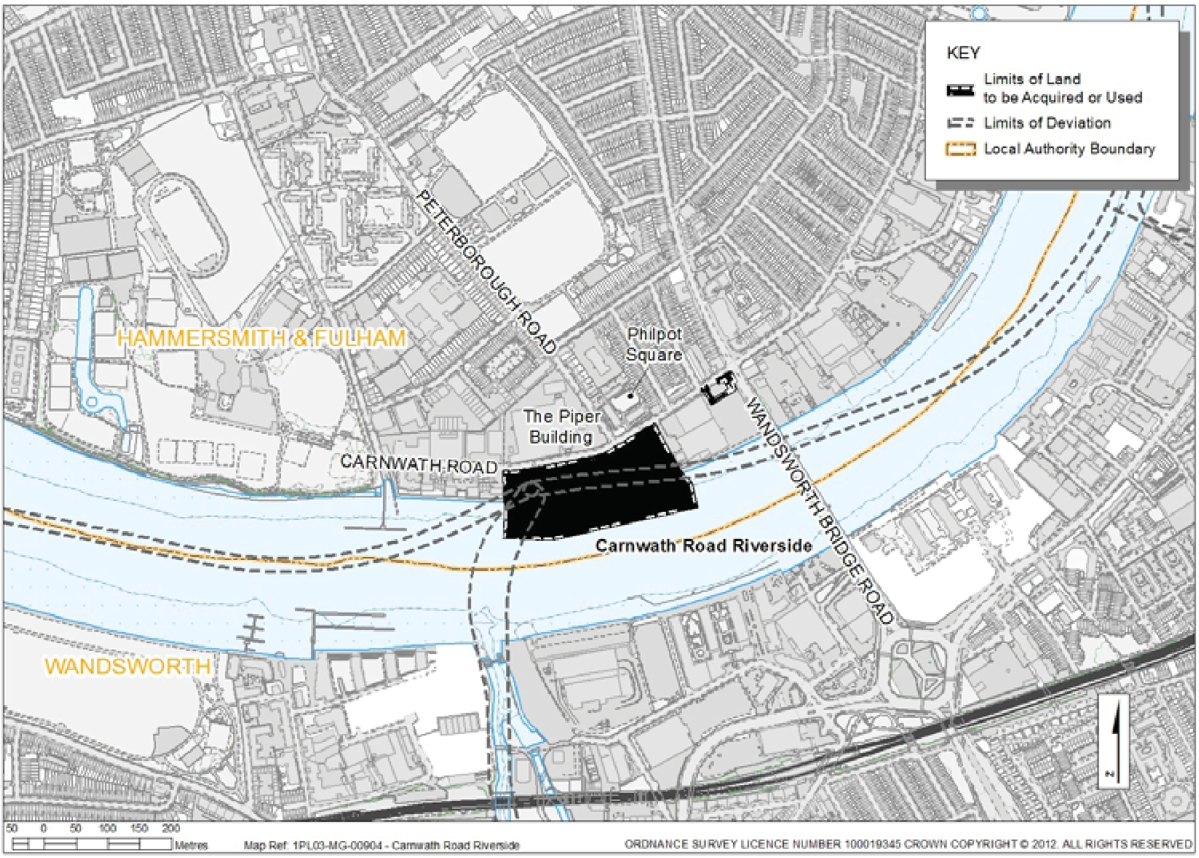
12 Carnwath Road Riverside

12.1 Existing site context

12.1.1 The proposed development site at Carnwath Road Riverside is located in the London Borough of Hammersmith and Fulham. It comprises two parts: a main site (which includes Whiffin Wharf, the safeguarded Hurlingham Wharf, Carnwath Road Industrial Estate, and an area of the River Thames foreshore) and a small highways works site.

12.1.2 The main site is bounded to the north by Carnwath Road, to the east and west by residential dwellings, and to the south by the River Thames. The highway works site is located at the junction of Wandsworth Bridge Road (A217) and Carnwath Road encompassing the northeast corner of a superstore car park. The site location and context are shown in Figure 12.1 to Figure 12.3.

Figure 12.1[1] Location of proposed Carnwath Road Riverside site



12.1.3 The surrounding area is characterised by a mix of land uses. The nearest dwellings are adjacent to the west and east of the site and to the north on the opposite side of Carnwath Road.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

12.1.4 Existing access to the site is via Carnwath Road.

12.1.5 Air quality management designations have been made by the London Borough of Hammersmith and Fulham covering the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

Figure 12.2 Aerial view of existing site

12.1.6 The foreshore area of the main site falls within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation.

12.1.7 The site lies within the Sands End Conservation Area. There is a modernist mural painted on The Piper Building on the opposite side of Carnwath Road which is locally listed.

12.1.8 There are no other environmental designations on or adjacent to the site.

Figure 12.3 Carnwath Road Riverside – site context

View towards main site looking south from Carnwath Road

View east along Thames Path with main site to the north (left)

View towards main site from river

Industrial estate on Carnwath Road (within the proposed site)

12.2 Proposed development

12.2.1 The purpose of this 3.6 hectare site (3.5 hectares for the main site and 0.1 hectares for the highway works site) is to enable the construction of the main tunnel and Frogmore connection tunnel (which runs between the King George's Park, Dormay Street and Carnwath Road Riverside sites). This would then enable the transfer of flows from the Frogmore connection tunnel to the deeper level of the main tunnel. The site would not directly intercept any combined sewer overflows.

12.2.2 Construction at Carnwath Road Riverside is assumed to start in 2016 and be completed by 2021. A shaft of approximately 42 metres deep with an internal diameter of approximately 25 metres would be constructed, predominantly in Whiffin Wharf. The location of the shaft avoids the safeguarded Hurlingham Wharf.

12.2.3 At the shaft, the tunnelling machine would be lowered into the shaft and driven from the Carnwath Road Riverside site to the Acton Storm Tanks site. The machine would progressively excavate the ground, with precast concrete segments being installed and joined together as the machine advances to form the tunnel. The shaft would be used to deliver precast concrete segments for the tunnel length under construction and also remove excavated material from the tunnel. Once this stretch of the tunnel is completed, the tunnelling machine would be removed at the Acton Storm Tanks site.

12.2.4 The site would also receive the tunnelling machines driven along the main tunnel from the Kirtling Street site and along the Frogmore connection tunnel from the Dormay Street site. The machines would be lifted out of the shaft at the Carnwath Road Riverside site by a heavy lift mobile crane before being cleaned and disassembled at ground level. The components would then be removed off site via road.

12.2.5 Continuous 24-hour working would be required at the site during the tunnelling and secondary lining works to ensure that work is completed safely and efficiently. During this period of continuous working, activities would be predominately below ground, with support activities occurring at ground level. Lorry movements would be limited to daytime hours. The average peak daily number of lorry trips at this site would be 45.

12.2.6 During construction, sections of the existing river wall would be replaced. This would require demolition of existing sections of wall and a new wall being constructed along the current alignment.

12.2.7 Barges would be used to transport the excavated material from the tunnel and the sands / gravels used to make concrete for the secondary lining of the tunnel. This would minimise the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

12.2.8 Barges would moor adjacent to the river wall within the site and would sit upon a flat granular bed, or ‘campshed’, during periods of low tide. This ensures that barges do not get stuck to the river bed with a potential risk of flooding of the barge during high tide. Alternatively, a temporary jetty may be built in the foreshore in front of the Carnwath Road Riverside site which would operate with a campshed. The average peak daily number of barges at this site would be two.

12.2.9 There would be an enclosure located over the shaft for the duration of 24 hour working to reduce noise effects on local residents. In addition, there would be other environmental controls in place throughout the construction phase to reduce potential impacts. These would include measures such as damping down materials and site roads with water to control dust, and ensuring safety for road users and pedestrians by controlling movement of vehicles.

12.2.10 To improve vehicle access between Wandsworth Bridge Road and Carnwath Road, junction improvements would be carried out on the southern side of Carnwath Road. This would comprise the realignment of the kerb line and adjacent carriageway / footway together associated landscaping.

12.2.11 The plan below (Figure 12.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which different components of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

12.2.12 To help explain this information, the schematic diagram below (Figure 12.5) illustrates where the structures may be located within these zones.

12.2.13 While most of the structures would be built underground, an above ground ventilation building of up to 5.5 metres in height would be constructed. The building would contain a number of fans to provide air circulation within the tunnel. The building would have a planted brown roof to promote local biodiversity. Previous designs included a larger above ground ventilation building. Through design development, there has been a reduction in size of this facility.

12.2.14 An above ground 15 metre ventilation column would also be required. The height of the structure, in combination with filters included in the below-ground structures, would control odour and minimise any effect on surrounding residents. The above-ground structures are shown in Figure 12.6.

12.2.15 The area immediately adjacent to the below ground structures would be finished in a hard landscape material to facilitate safe operational access. The area would be accessible to the general public, providing a new public open space.

12.2.16 Operational lighting of the Thames Path and the new public open space would be designed to avoid light pollution. Lighting may also be incorporated into the final design of the ventilation column.

12.2.17 Once operational, routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Access for operational vehicles would be via a new access point off Carnwath Road.

Figure 12.4 Proposed development at the Carnwath Road Riverside site

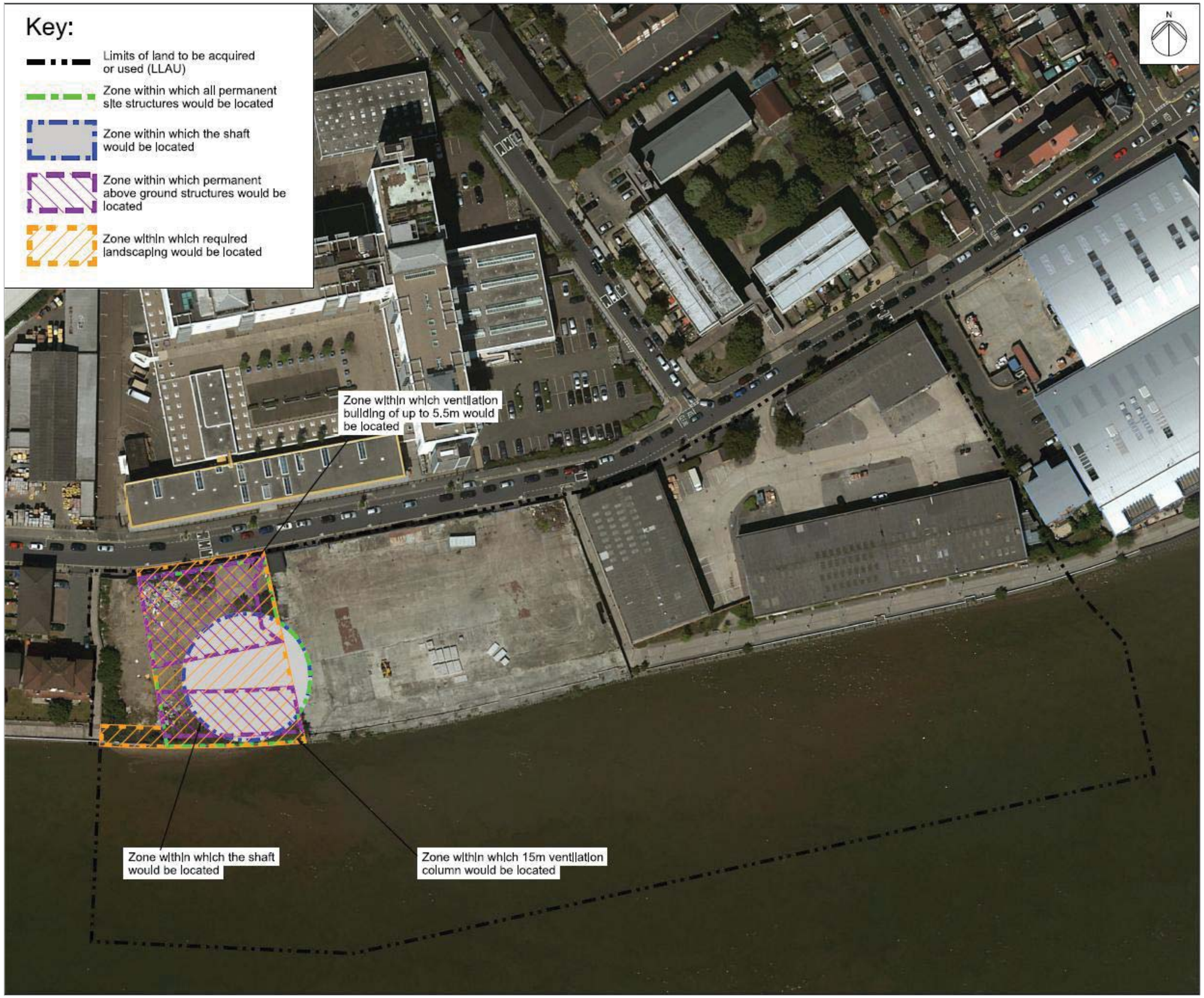


Figure 12.5 Schematic layout at the Carnwath Road Riverside site

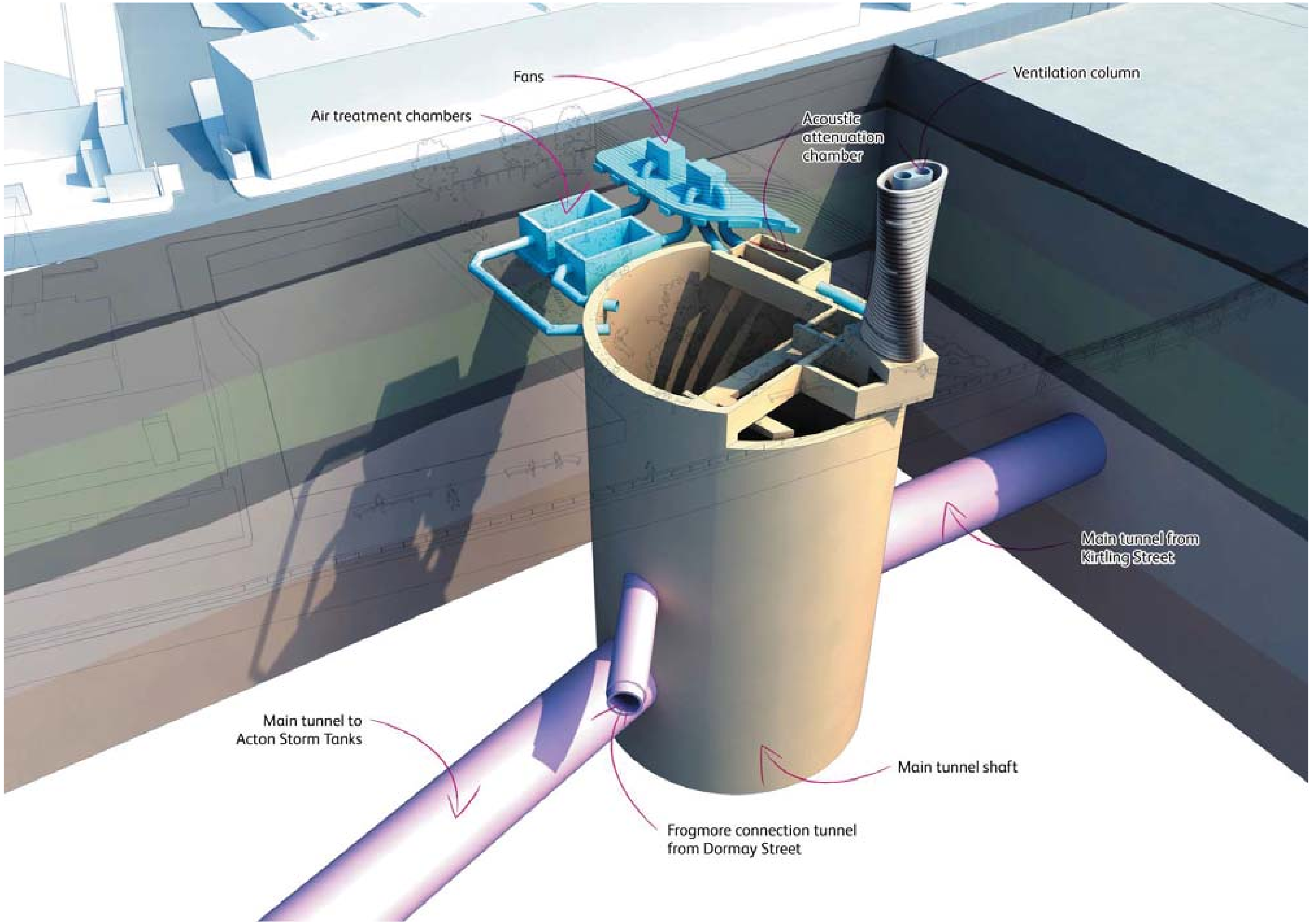


Figure 12.6 Carnwath Road Riverside site – illustrative aerial view

12.3 Effects of the proposed development at Carnwath Road Riverside on the environment

Introduction

12.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

12.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary, with full details contained in Volume 2 of the *Environmental Statement*.

12.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Carnwath Road Riverside site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 10 of the *Environmental Statement*.

Effects during construction

12.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles, including lorries and tug boats (for river barges), that are used to move materials and equipment for the project. This could affect local residents and businesses as well as people who use the Thames Path for recreation. Based on computer modelling, it is predicted that pollutants from traffic associated with construction would not result in a likely significant effect on local residents and businesses or recreational users of the Thames Path. This is due to the minor increase in pollutant concentrations predicted.

12.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

12.3.6 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. A range of noise control measures would be applied to minimise effects from construction activities, for example the construction area around the main shaft would be enclosed by a building whilst the tunnel is constructed and lined, and other plant would also be enclosed to reduce noise. Hoardings would also be put in place to limit noise. With these measures in place, noise from the construction site is not likely to be significant at any locations.

12.3.7 While there would not be any significant noise effects from road-based construction traffic (due to small changes in traffic noise levels predicted), significant adverse effects would be likely from river based construction traffic at residential properties at 89-101 Carnwath Road. It is not possible to further reduce the effect through on site controls, but the residents of 89-101 Carnwath Road may be eligible to apply for compensation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*.

Figure 12.7 Residential properties on Carnwath Road (including 89-101 to the east (right))

12.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

12.3.9 In terms of townscape, there are likely to be significant adverse effects on the character of the townscape around the site, along the River Thames and the residential area around Point Pleasant on the opposite bank of the River Thames. This would be due to the demolition of buildings and the presence of construction activity and continuous loading of barges. Beyond this, the existing industrial character of the area and/or distance from the works and screening provided by trees and buildings means that townscape effects would not be significant.

Figure 12.8 Existing site and with planned construction works in place

12.3.10 People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects, that is effects on their experience of views. Likely significant adverse effects have been identified on the residential viewpoints along Carnwath Road and some residences on the opposite bank of the River Thames. In terms of recreational viewpoints, significant adverse effects are likely on users of the Thames Path adjacent to Carnwath Road, Wandsworth Bridge and The Ship public house. These adverse effects are due to the visibility of construction activities during the daytime. No other viewpoints are predicted to experience significant effects, due to the industrial context and/or construction works only being partially visible or in the background or periphery, filtered through trees and buildings, or due to distance.

12.3.11 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account the findings of the noise, vibration, air quality, construction dust and visual assessments. Likely significant adverse effects have been identified on the amenity of nearby residents due to the noise and/or visual effects described above. No likely significant amenity effects have been identified on businesses, users of the River Thames and the Thames Path.

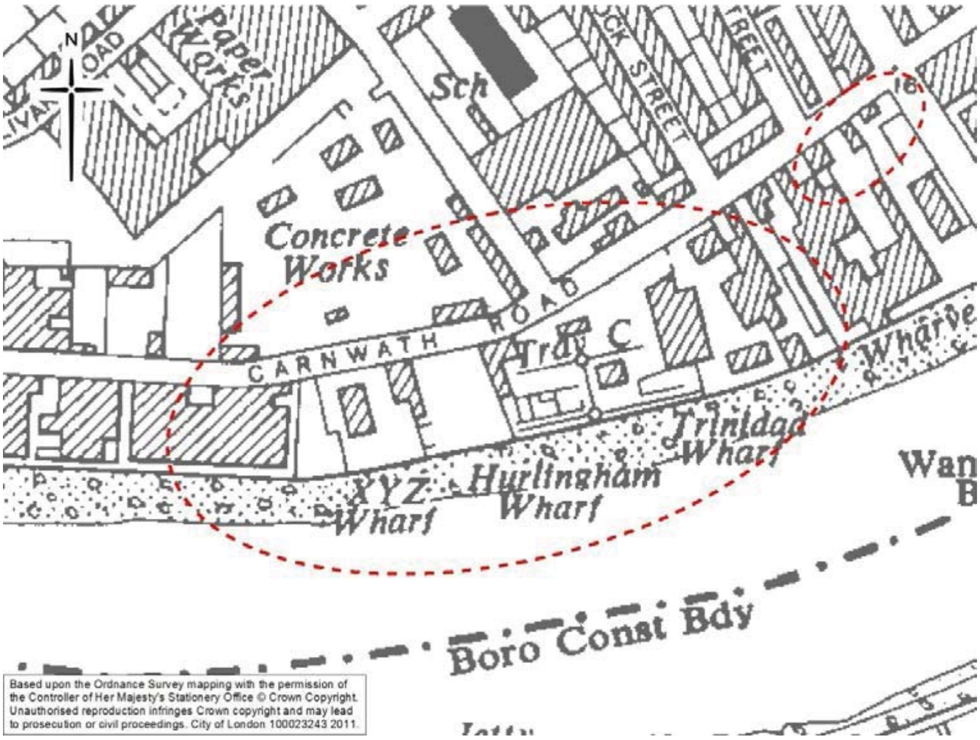
12.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of road users, pedestrians and cyclists would ensure that there would be no likely significant transport effects. Improvement of the junction of Carnwath Road and Wandsworth Bridge Road is proposed, in the form of kerb realignment, in order to allow larger construction vehicles to turn left into Carnwath Road.

Figure 12.9 View east along Carnwath Road (existing)

12.3.13 A study of historical maps, previous archaeological records and research into local history has been undertaken to build up a picture of the possible below ground remains (Figure 12.10). Construction works would involve changes to both above ground features as well as the environment below ground.

12.3.14 Information gathering has revealed that there is potential for the site to have remains of prehistoric timber structures, and post-medieval remains of 19th century industrial buildings and wharves, although these more recent remains would be of less value in terms of building up an understanding of the history of the area. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

Figure 12.10 Ordnance Survey 6”: mile map of 1954−8 (not to scale)



12.3.15 No significant physical effects are predicted on above ground historic features. There would however be a likely significant adverse effect on the character and appearance of the Sands End Conservation Area due to the visibility of construction works.

12.3.16 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past, and ongoing activities, which could result in contamination. This may in turn affect construction workers and adjacent premises. Contaminative land uses are known to have taken place on and around the site, including a petroleum depot and chemical works, and the current land use of light industrial and commercial units could also have introduced contamination. Risk assessments would be undertaken prior to the start of construction, with a site-specific remediation strategy produced and implemented if required. During construction, health and safety measures for the protection of construction workers would be followed, including in relation to unexploded bombs, which could be present due to the heavy bombing of London during World War II. With these measures in place no likely significant effects from below ground works leading to a release of contaminants have been identified.

12.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a ‘pathway’) is created, resulting in pollution. At this site, measures such as bunded fuel stores to reduce the risk of spills and treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

12.3.18 Construction activity could affect water quality in the River Thames. However, with construction controls in place to prevent polluting substances entering the river, no significant effects on water quality are predicted. Construction works taking place in the river could also affect the river channel, but again no significant effects are predicted because the channel is already modified by flood defences and dredging, and natural processes would reinstate the river bed following temporary construction works in the river.

12.3.19 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The findings of the assessment indicate that there would be no change in flood risk during construction and therefore no significant effect in respect of flood risk.

Figure 12.11 River wall within the main site comprising sections of concrete and sheet piling

12.3.20 Construction works adjacent to and within the river could also affect the ecology of the River Thames. The river bed, river wall and river itself can provide habitat for fish, invertebrates and marine mammals. The construction works would lead to some temporary loss of habitat, but this would not give rise to likely significant effects on species. The only exception to this is with the jetty option (paragraph 12.2.8) which would be likely to have significant adverse effect on fish, due to loss of feeding, resting and nursery habitat. Light spillage from the jetty could also have a significant adverse effect on breeding fish for specific times of year, namely from March to May, but would not be significant for the rest of the year.

12.3.21 The site and surrounding area on shore provides some limited semi-natural habitat in an otherwise urban area, including semi-mature scattered trees and scrub. Bats are known to pass through the site, some common birds may use the site for foraging and nesting, and wintering birds are also known to use the foreshore. Construction would lead to a temporary loss of habitat for some species, and some low levels of disturbance due to noise and lighting. However, this is not predicted to give rise to significant effects. Nesting features are proposed to be installed at the end of construction which is likely to have a significant beneficial effect on one species of bird, the black redstart.

12.3.22 The assessment has considered other developments that are planned within the vicinity of this site and during the same timeframe and which could interact with the construction work at the Carnwath Road Riverside site. No significant elevated cumulative effects are predicted, with the exception of effects on the character of the townscape at two locations. The townscape character of the Sherwood Wharf residential area and the industrial area around Smugglers Way, both opposite the site on the other (southern) side of the River Thames, would experience significant adverse effects due to concurrent construction activity at the Carnwath Road Riverside site with a riverside development in Wandsworth (on the opposite side of the river).

Effects during operation

12.3.23 The operational site would include a 15 metre ventilation column. Below ground chambers would contain filters to remove odours before air is released from the column. The height of the ventilation column would allow the elevated release of expelled air. This together with the filters would ensure there would be no likely significant effects from odour during operation.

12.3.24 Noise and vibration from operational plant, maintenance activities as well as from operational traffic have been assessed. Any noise generated by ventilation and other plant equipment would be minimised by technology included in the design, and therefore there would be no likely significant effect from noise from this source. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities. In addition, the Frogmore connection tunnel would bring flows of sewage into the lower half of the shaft at the Carnwath Road Riverside site, which would be channelled down to the main tunnel. No likely significant noise effects have been identified from this.

12.3.25 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. Maintenance visits would lead to some temporary, short-term delay to users of the local road network, as well as require the infrequent suspension of a small number of parking bays but this would not give rise to likely significant effects.

12.3.26 There are likely to be significant beneficial effects on the townscape character of areas on the opposite side of the River Thames due to the introduction of a new public open space and a high quality building to house operational equipment. All effects on viewpoints would be beneficial. In most cases these would not be significant apart from views from the Thames Path along Carnwath Road which over time would benefit from trees within the new public open space.

12.3.27 In terms of socio-economics, the new public open space would also lead to likely significant beneficial effects by providing a new recreational opportunity.

12.3.28 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

12.3.29 The fully built project would not alter flood risk at the site, due the project not altering flood defences. Therefore the operational flood risk effects would not be significant.

12.3.30 No other developments are planned nearby that would interact with the operational development at the site and therefore no significant cumulative effects have been identified.

12.3.31 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, an assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no effects in terms of land based ecology or contaminated land and therefore these topics have not been assessed.

c. There would also be no likely significant effects on surface water or aquatic ecology as there would be no sewer interception at this site so these have not been assessed.

12.4 Further information

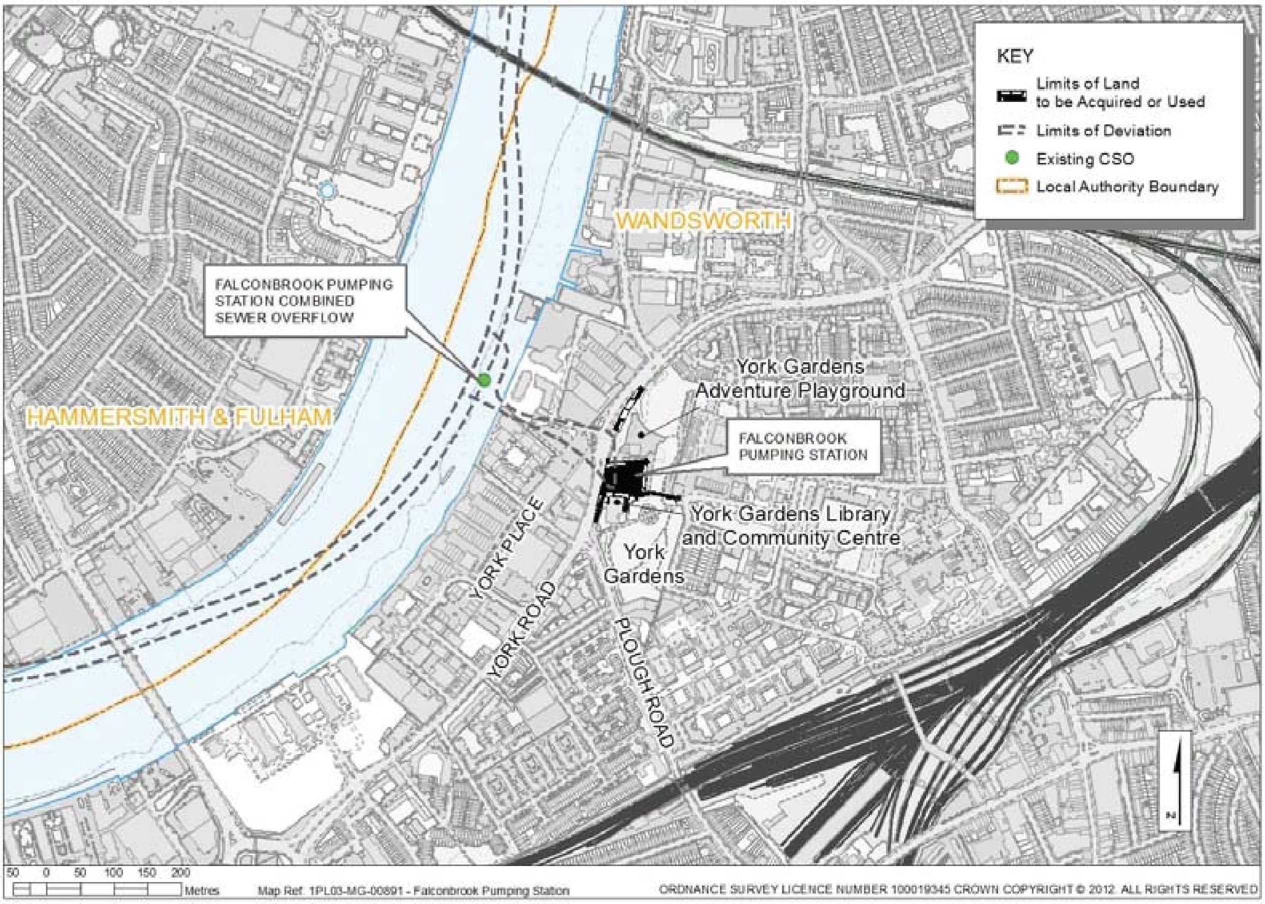
12.4.1 Further information regarding the assessment of the Carnwath Road Riverside site can be found in Volume 10 of the *Environmental Statement*.

13 Falconbrook Pumping Station

13.1 Existing site context

13.1.1 Falconbrook Pumping Station is an existing Thames Water pumping station site located in the London Borough of Wandsworth. The site comprises two parts; a main site encompassing the pumping station and a disused public convenience, and a highway works site located to the north of the main site.

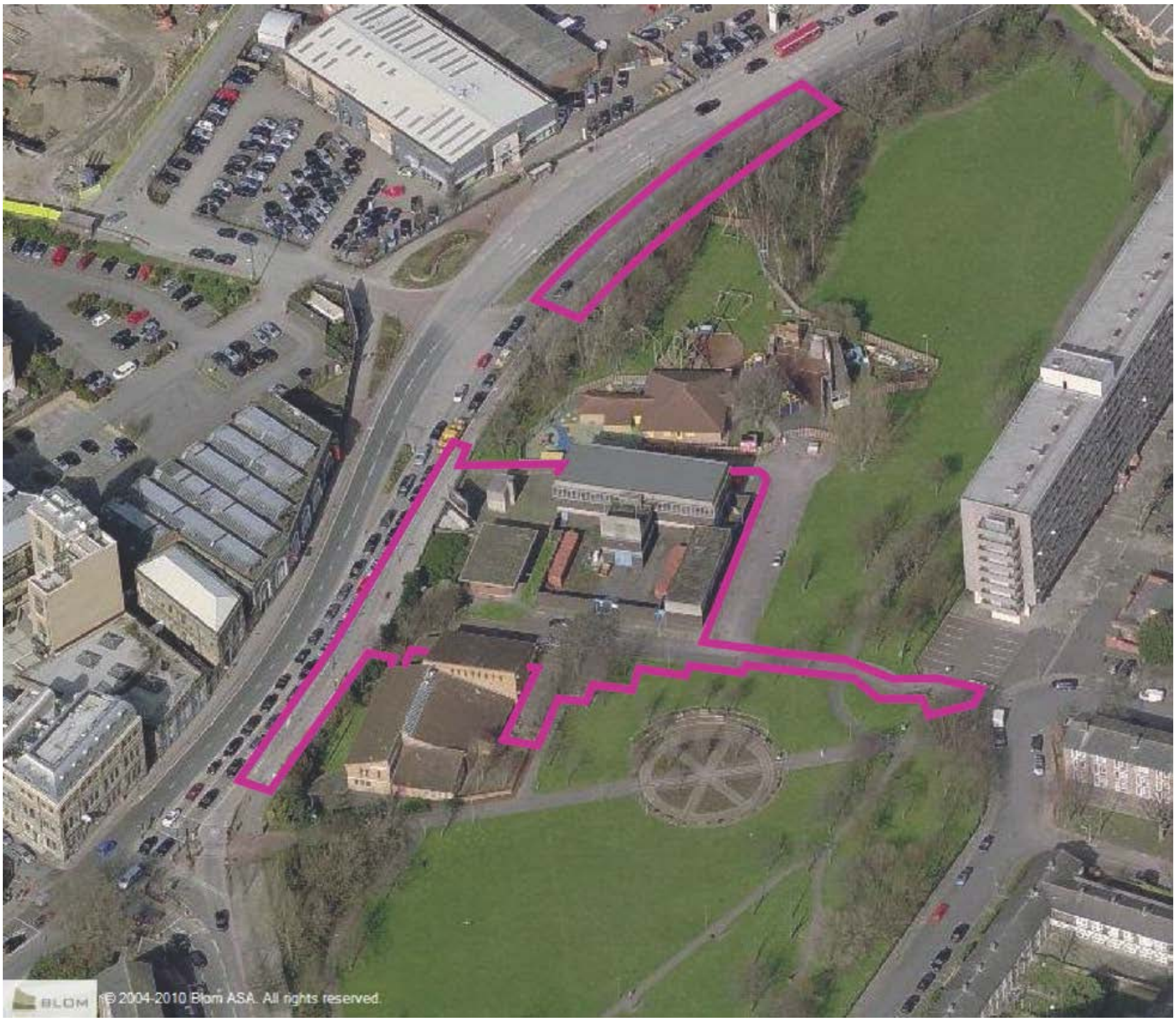
Figure 13.1[1] Location of proposed Falconbrook Pumping Station site



13.1.2 The main site is bounded to the north by the York Gardens Adventure Playground, to the east and southeast by York Gardens and the York Gardens Library and Community Centre, and to the west by York Road (A3205). The highway works site is located on a section of York Road on the northwestern boundary of York Gardens. Figure 13.1 to Figure 13.3 show the site location and context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Figure 13.2 Aerial view of existing site



13.1.3 Air quality management designations have been made by the London Borough of Wandsworth covering the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

13.1.4 The site lies within York Gardens which is a designated Site of Importance for Nature Conservation as well as the Wandsworth Archaeological Priority Area. There are no other environmental designations on or adjacent to the site.

Figure 13.3 Falconbrook Pumping Station – site context

View from York Road east towards Falconbrook Pumping Station

York Gardens

View from York Gardens east towards Pennethorne House

View along York Road

13.2 Proposed development

13.2.1 The purpose of this 0.53 hectare site (0.45 hectares for the main site and 0.08 hectares for the highways works site) would be to intercept a sewer overflow which currently discharges untreated sewage into the River Thames on average 42 times each year, at a total volume of 709,000m3. This is equivalent to approximately 284 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, in most years there would be approximately four discharges of untreated sewage into the River Thames from this combined sewer overflow.

13.2.2 At the site, flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the Thames Tideway Tunnel via a drop shaft and associated connection tunnel.

13.2.3 Construction at Falconbrook Pumping Station site is assumed to start in 2018 and be completed by 2020. Advance tree planting within York Gardens would provide visual screening from the construction activities.

13.2.4 A shaft of approximately 40 metres deep with an internal diameter of approximately 9 metres would be constructed to the west of the existing pumping station. The existing disused public convenience building, the screening chamber building and sections of the pumping station compound wall would be demolished to enable construction of the shaft and other structures. The existing illuminated advertising hoarding would be dismantled and removed from site.

13.2.5 Environmental controls would be in place throughout the construction phase. Measures would include damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

13.2.6 A short period of 24-hour working would be required for construction of the connection tunnel and secondary lining works. During this period of continuous working, activities would be predominately below ground, with support activities occurring at ground level. Lorry movements would be limited to daytime hours.

13.2.7 Two temporary vehicle accesses would be constructed off York Road to provide site access for construction vehicles. This would avoid construction vehicles travelling along the residential roads to the east of the site. As this site is inland, materials would be transported to and from the site by road, rather than by barge on the river. The average peak daily number of lorry trips at this site would be 18.

13.2.8 The plan below (Figure 13.4) shows the layout of the proposed development for which consent is sought. The plan shows a series of zones within which different aspects of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

13.2.9 To help explain this information, the schematic diagram below (Figure 13.5) illustrates where the structures may be located within these zones.

13.2.10 While most of the structures would be underground, an integrated above ground ventilation structure and column would be built. This would be located within the compound area of the existing pumping station. A planted brown roof would enclose the structure to promote local biodiversity. This structure would be approximately three metres high, with the ventilation column extending to between four and eight metres in height.

13.2.11 A second ventilation column serving the existing below ground screening chamber would also be located within the compound of the existing pumping station. This would be six metres in height. Early design located the ventilation columns outside the existing pumping station compound. However, the location was subsequently revised to minimise the number of above ground structures within the area accessible to the public.

13.2.12 The height of the ventilation columns, in combination with filters included in the below-ground structures, would control odour and minimise any effect on surrounding residents. The above ground structures are shown in Figure 13.6.

13.2.13 The area adjacent to the below ground structures would be finished in a hard landscape material to facilitate safe operational access. The area surrounding the shaft would be accessible to the general public and form an improved pedestrian access to York Gardens.

13.2.14 Operational lighting of the publicly accessible area in York Gardens would be designed to avoid light pollution and to reduce the risk of crime.

13.2.15 Once the construction works are complete, the two temporary vehicle accesses off York Road would be removed.

13.2.16 During operation, routine inspections would be made every three to six months and major maintenance work carried out every ten years. Operational access to the new infrastructure would use the residential roads to the east and be the same as currently used to access the existing pumping station.

Figure 13.4 Proposed development at the Falconbrook Pumping Station site

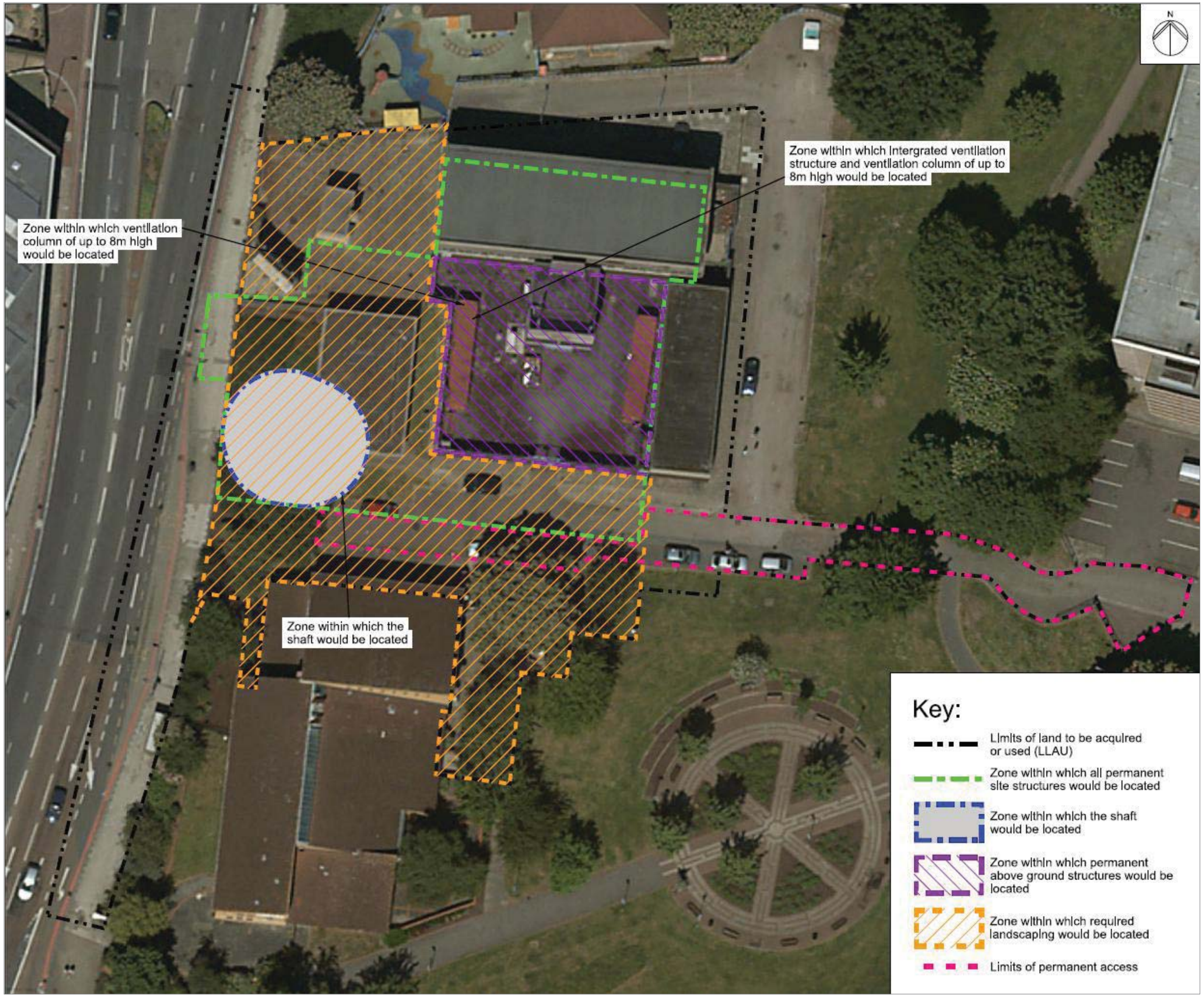


Figure 13.5 Schematic layout at the Falconbrook Pumping Station site

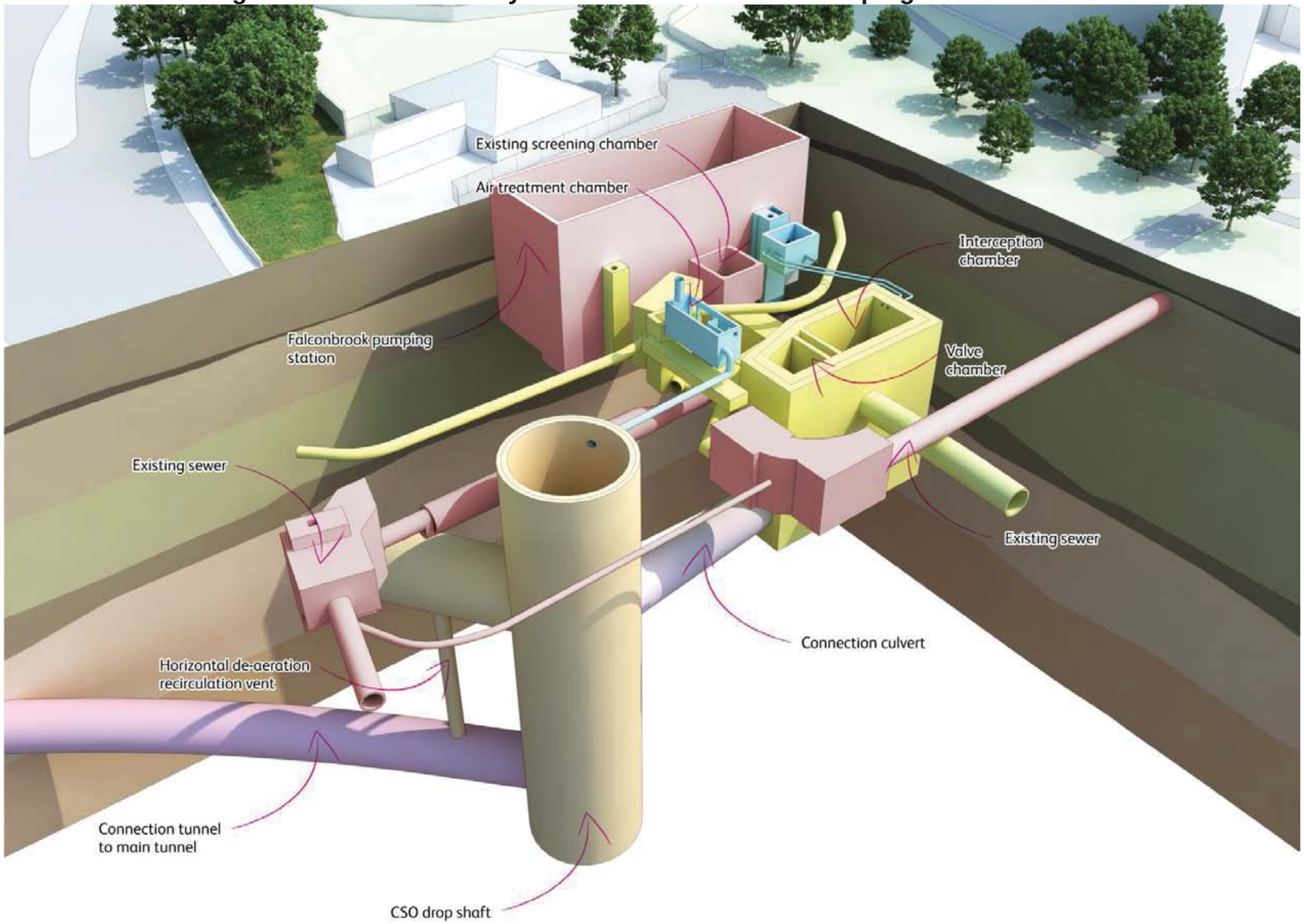
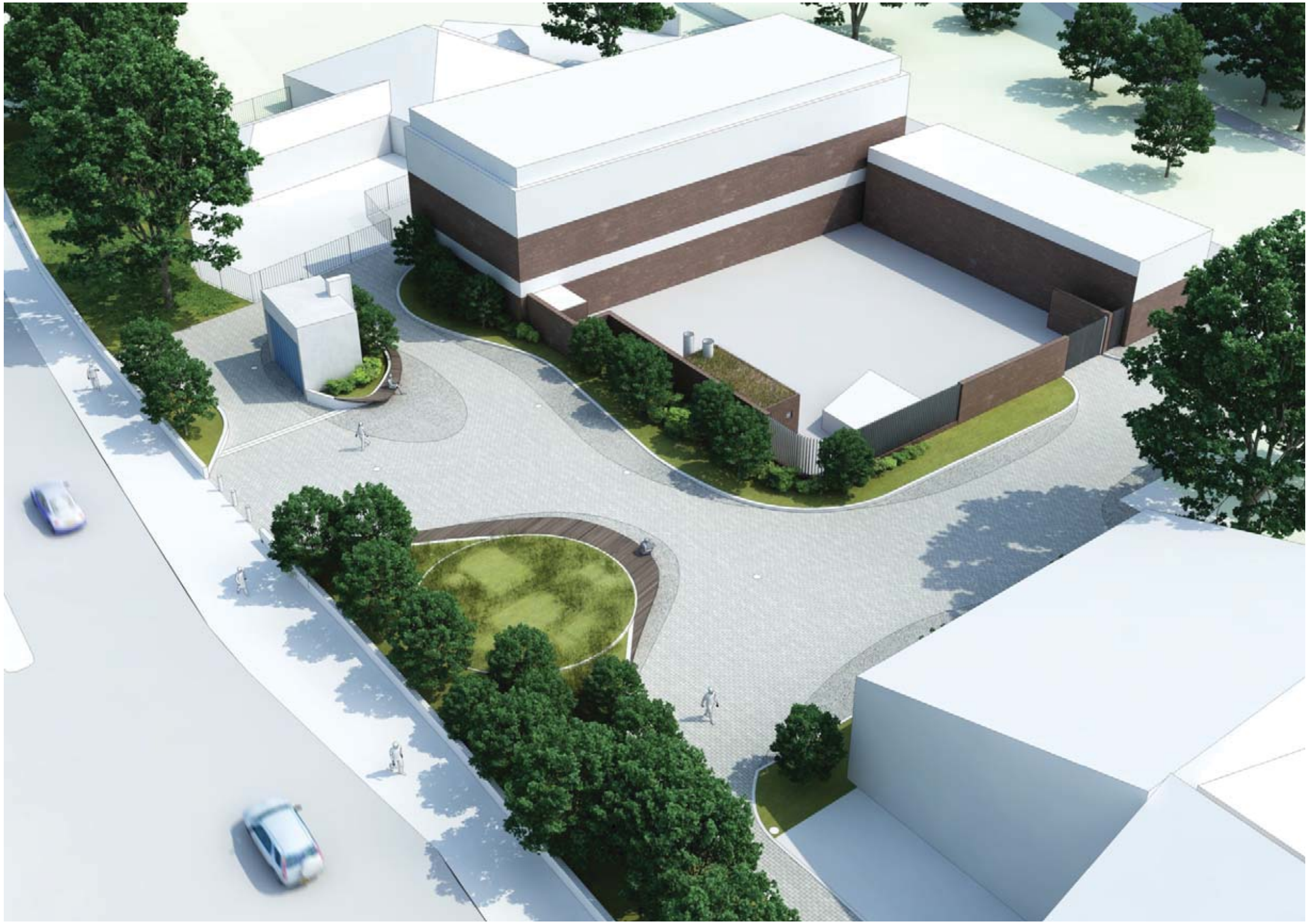


Figure 13.6 Falconbrook Pumping Station site – illustrative aerial view



13.3 Effects of the proposed development at Falconbrook Pumping Station on the environment

Introduction

13.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

13.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

13.3.3 The following section describes the likely significant effects (both beneficial and adverse) arising from the proposed development at the Falconbrook Pumping Station site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 11 of the *Environmental Statement*.

Effects during construction

13.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties such as businesses or users of the community and recreational facilities in the area. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in any significant effects. This is due to the small increase in pollutant concentrations predicted.

13.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction would be applied including dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

13.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. There would not be any significant noise effects from construction traffic due to the small changes in traffic noise levels predicted. With regard to noise effects from construction plant, noise levels at sensitive locations would not exceed specified thresholds and therefore there would be no likely significant effects.

13.3.7 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

13.3.8 In terms of townscape there would be only minor alterations to the townscape character typical of a major engineering project including construction equipment such as cranes. Effects would not be significant.

13.3.9 Likely significant adverse effects have been identified on residential viewpoints from Pennethorne House residence (Figure 13.3) as well as on recreational viewpoints from both the northeast entrance to York Gardens and northwest from within York Gardens, due to the visibility of construction works. Effects on other viewpoints would not be significant due to the partial visibility of construction works, distance to the site, and the presence of trees, hoardings, and/or advance planting to filter and screen views.

13.3.10 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. It also considers local businesses, as well as users of open space and community facilities. As described above, likely significant adverse effects were identified for viewpoints relevant to York Gardens users. However, these viewpoints are not considered to be critical to the experiences of recreational users of these spaces. Therefore there would be no likely significant amenity effects on the local residents and businesses, or users of community and recreational facilities near to the site.

13.3.11 The measures proposed as part of the project to minimise disruption and ensure the safety of road users, pedestrians and cyclists would ensure that there are no significant transport effects. While some parking spaces would require removal along the access road to York Gardens Library and Community Centre (Figure 13.7) and the York Gardens Adventure Playground for the duration of construction, this would not have a likely significant effect on the basis that there is available spare capacity of on-street parking in the vicinity of the site.

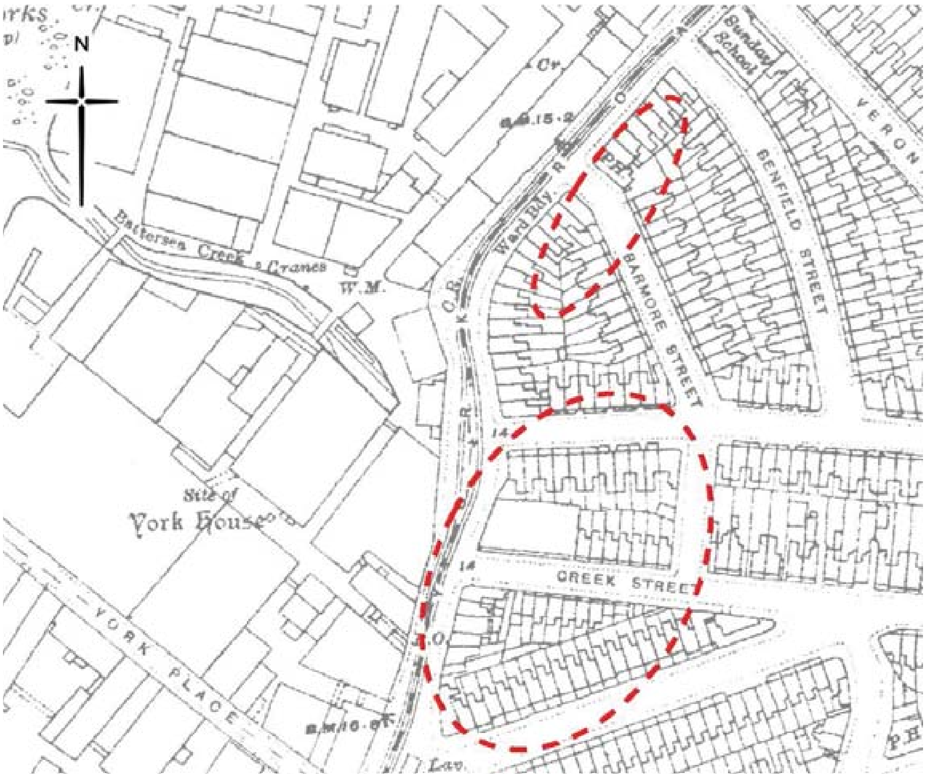
Figure 13.7 York Gardens Library and Community Centre

13.3.12 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up (Figure 13.8). Construction work on site would involve changes to both above ground features as well as the environment below ground.

13.3.13 The site at Falconbrook Pumping Station has the potential to contain evidence of medieval settlements, and other archaeological remains. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

13.3.14 With regard to above ground features, a cobbled mid-19th century road surface to the west of the pumping station within the site would be removed during construction, stored and reinstated or reused where possible. Effects on this asset therefore would not be significant.

Figure 13.8 Ordnance Survey 3rd edition 25": mile map of 1909–20



13.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. Whilst there is no evidence of specific contamination events at the site, due to the current and historic use of the site as a sewage pumping station it is assumed that soil contamination may be present. However, no likely significant effects have been identified for construction workers, adjacent land-users, or the surrounding built environment in relation to exposure of contaminated material released during construction activities. Risk assessments would be undertaken prior to the start of construction, and health and safety measures for the protection of construction workers would be followed. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means that there would be no significant effects relating to unexploded bombs.

13.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created, resulting in pollution. At the Falconbrook Pumping Station site, measures such as bunded fuel stores and treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

13.3.17 While the Falconbrook Pumping Station site lies inland (Figure 13.9), construction activity could affect water quality in the River Thames through run-off from the site to the river via surface water drains. However, with the proposed site drainage and construction practices in place to minimise the risk of pollution, no significant effects are predicted.

13.3.18 Flooding may occur from various sources, such as tidal and river sources, as well as surface water, groundwater and sewers at this location. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with sources of flooding. However, the finding of the flood risk assessment for the site is that there would be no change in flood risk during construction and there would be no significant effect in respect of flood risk. Therefore there is no significant effect in respect of flood risk.

13.3.19 As the Falconbrook Pumping Station site is inland and does not involve any construction works in the river, construction effects on river-based ecology would not be significant.

Figure 13.9 View towards Falconbrook Pumping Station with York Gardens Adventure Playground in the background (right in photograph)

13.3.20 As there would be no change to bat, bird or invertebrate populations as a result of construction at the site, there would not be a significant effect on these species. Similarly, no significant effect is anticipated for the York Gardens Site of Importance for Nature Conservation. Although there would be a temporary reduction in its extent, there would not be a significant effect due to the advance planting and reinstatement of vegetation.

13.3.21 As well as replanting of vegetation at the end of construction, there would be an increase in habitat at the Falconbrook Pumping Station site due to advance planting prior to construction and the inclusion of a brown roof in the design on the ventilation structure. Therefore there is a likely significant beneficial effect on terrestrial ecology with relation to habitat at the site.

13.3.22 The Chelsea Creek development is planned nearby during the same timeframe as the construction work at the Falconbrook Pumping Station site. However, due to the distance between the two sites, no significant cumulative effects have been identified. In addition, the transport assessment used a model that accounted for traffic increases associated with construction of the Chelsea Creek development, and as such no additional cumulative assessment is required.

Effects during operation

13.3.23 The operational site would include a ventilation structure, in which air treatment filters would be installed to remove odour. Treated air would then be released via ventilation columns. The height of the ventilation columns would allow the elevated release of expelled air and therefore there would be no significant effect from odour.

13.3.24 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Any noise generated by other plant equipment would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground and a number of structures provide a barrier to noise and vibration, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

13.3.25 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term temporary parking restrictions on adjacent roads to allow safe access to the site. This infrequent operational activity would not lead to significant effects.

13.3.26 There are no significant effects predicted on the townscape character areas surrounding the site during the operation of the site. The advance planting undertaken prior to the commencement of construction would filter views to the above ground structures, resulting in a likely significant beneficial effect on residential views from Pennethorne House and Newcomen Road during the summer. The new area of public space and advance planting would also result in a likely significant beneficial effect on the recreational viewpoint from within York Gardens in the summer. No significant effects are expected for other viewpoints.

13.3.27 In the operational phase, the creation and landscaping of a new area of public space would not have a significant effect on amenity of the users of York Gardens. This is because although it creates an overall beneficial enhancement of the area, the area is relatively modest in comparison to the rest of York Gardens.

13.3.28 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

13.3.29 The fully built project would not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

13.3.30 The effect of the proposals at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected. As a result, there would be significant beneficial effects on water quality.

13.3.31 Associated with the improvement in water quality would be significant beneficial effects on river based ecology. Fish would benefit significantly from a reduced occurrence of low oxygen levels and improved foraging habitat. In addition there is likely to be an increase in the distribution of species which are sensitive to pollution.

13.3.32 No other developments are planned nearby that would interact with the operation of the project at the site and so no significant cumulative effects have been identified.

13.3.33 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no effects in terms of land quality, or on features of historic interest, below or above ground, and therefore effects on these aspects of the environment were not assessed.

c. Given the limited area taken up by the operational site, infrequent maintenance requirements, and that the design would include minimal permanent operational lighting, significant effects on land-based ecology are not likely, and therefore were not assessed.

13.4 Further information

13.4.1 Further information regarding the assessment of the Falconbrook Pumping Station site can be found in Volume 11 of the *Environmental Statement*.

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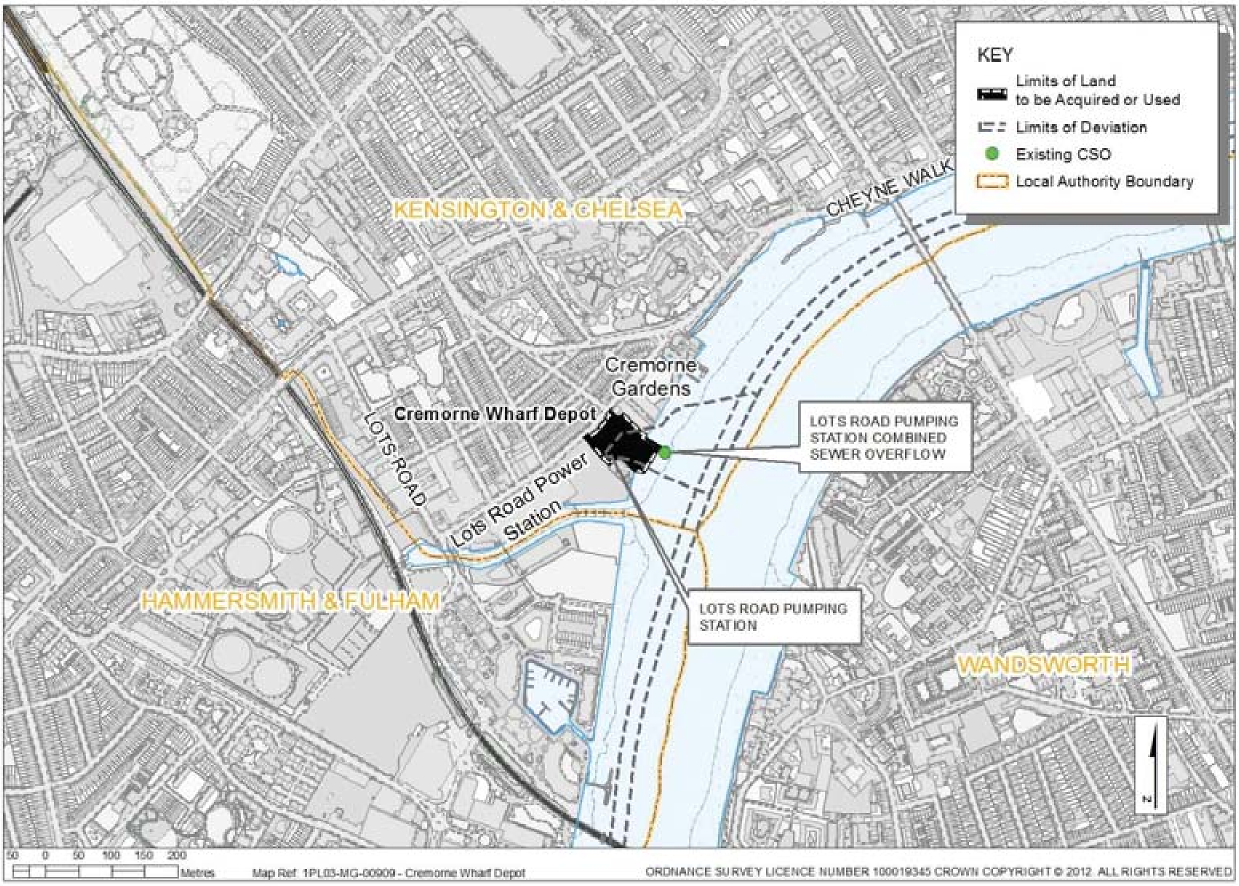
14 Cremorne Wharf Depot

14.1 Existing site context

14.1.1 The proposed development site is located in the Royal Borough of Kensington and Chelsea. It comprises the existing council depot located within the safeguarded Cremorne Wharf (including jetty facilities), the Grade II listed Thames Water Lots Road Pumping Station, and an existing campshed in the foreshore of the River Thames. The Lots Road Pumping Station combined sewer overflow currently discharges into the River Thames under the jetty.

14.1.2 As shown in Figure 14.1 the site is bounded to the northeast by Chelsea Wharf, the east and south by the River Thames and Chelsea Creek (which forms the boundary with the London Borough of Hammersmith and Fulham), the west by Lots Road, and to the southwest by the Lots Road Power Station redevelopment.

Figure 14.1[1] Location of proposed Cremorne Wharf Depot site



14.1.3 The surrounding area is predominantly residential and mixed-use. Currently the nearest dwellings are at Chelsea Wharf and opposite the

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

site along Lots Road. Figure 14.1 to Figure 14.3 show the site and local context.

14.1.4 Existing access to the site is from Lots Road through the council depot entrance located to the northwest of the Lots Road Pumping Station. There is a separate exit to the west of the Lots Road Pumping Station forming a one way system.

Figure 14.2 Aerial view of existing site

14.1.5 Air quality management designations, which cover the whole borough, have been made by the Royal Borough of Kensington and Chelsea. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

14.1.6 The site lies within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation.

14.1.7 The Grade II listed Thames Water Lots Road Pumping Station is located within the site. The site also lies partially within the Thames Conservation Area. There are no other environmental designations on or adjacent to the site.

Figure 14.3 Cremorne Wharf Depot – site context

View northwards to Cremorne Wharf Depot

View looking west towards site

Existing sewer outlet beneath jetty

Residential dwellings on Lots Road, beyond Lots Road Power Station development site

14.2 Proposed development

14.2.1 The purpose of this 0.6 hectare site would be to intercept the Lots Road Pumping Station sewer overflow which currently discharges untreated sewage into the River Thames on average 38 times each year, at a total volume of 1,140,000m^3. This is equivalent to approximately 460 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed main tunnel, there would be approximately four discharges of untreated sewage into the River Thames per year from this combined sewer overflow.

14.2.2 Construction at Cremorne Wharf Depot is assumed to start in 2018 and be complete by 2020. A shaft approximately 42 metres deep with an internal diameter of approximately 8 metres would be constructed in the land between the existing pumping station building and the river wall. The existing depot building would be demolished in order to allow construction of the shaft and other structures.

14.2.3 Excavated material arising from construction of the shaft and other structures would be transported using barges (the existing campshed on the site would be upgraded as necessary for the barges to use at periods of low tide), minimising the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

14.2.4 During construction, vehicles would access the site from the two existing access points, one each side of the pumping station building. The average peak daily number of lorry trips at this site would be 12 and the average peak daily number of barges would be one.

14.2.5 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, ensuring safety for road users and pedestrians by controlling movement of vehicles, and restricting working hours to limit the effects of noise and transport movements on neighbours.

14.2.6 The plan below (Figure 14.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which different components of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

14.2.7 To help explain this information, the schematic diagram in Figure 14.5 illustrates where the structures may be located within these zones.

14.2.8 While most of the structures would be underground, two new 4 to 8 metre high ventilation columns would be located on the site to ventilate the shaft (see Figure 14.6).

14.2.9 Additionally an existing ventilation column on the corner of the pumping station building would be used to ventilate the structures connecting to the existing outfall. Following stakeholder engagement as part of the design development, it was agreed to improve the appearance of this ventilation column so that it is more in keeping with the Grade II listed pumping station building.

14.2.10 Below-ground equipment would be controlled by electrical and control equipment located within the existing pumping station building.

14.2.11 The height of the ventilation columns, in combination with filters included in the below-ground structures, would control odour and minimise any effect on surrounding residents.

14.2.12 After construction of the shaft and other structures is complete, the depot building would be reinstated. Subject to the agreement of the landowner, it would be reinstated with a brown roof designed to promote local biodiversity and provide an absorptive surface to reduce rainwater runoff. Operational lighting would be the same as existing.

14.2.13 Once operational, routine inspections of the site would be made every three to six months and major maintenance work would be carried out every ten years. Access to the site would continue to be from Lots Road through the existing access points.

Figure 14.4 Proposed development at the Cremorne Wharf Depot site

Figure 14.5 Schematic layout at the Cremorne Wharf Depot site

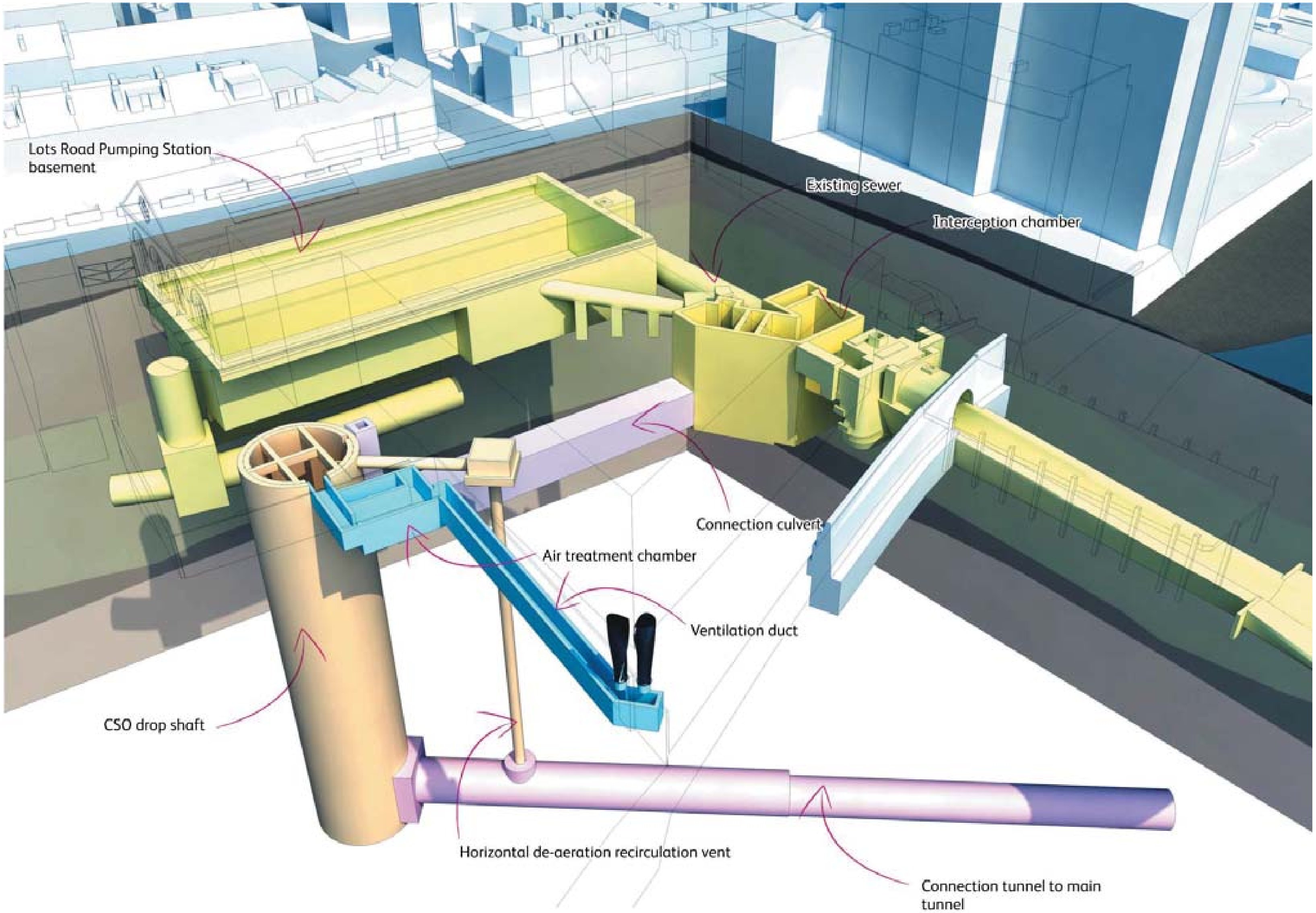
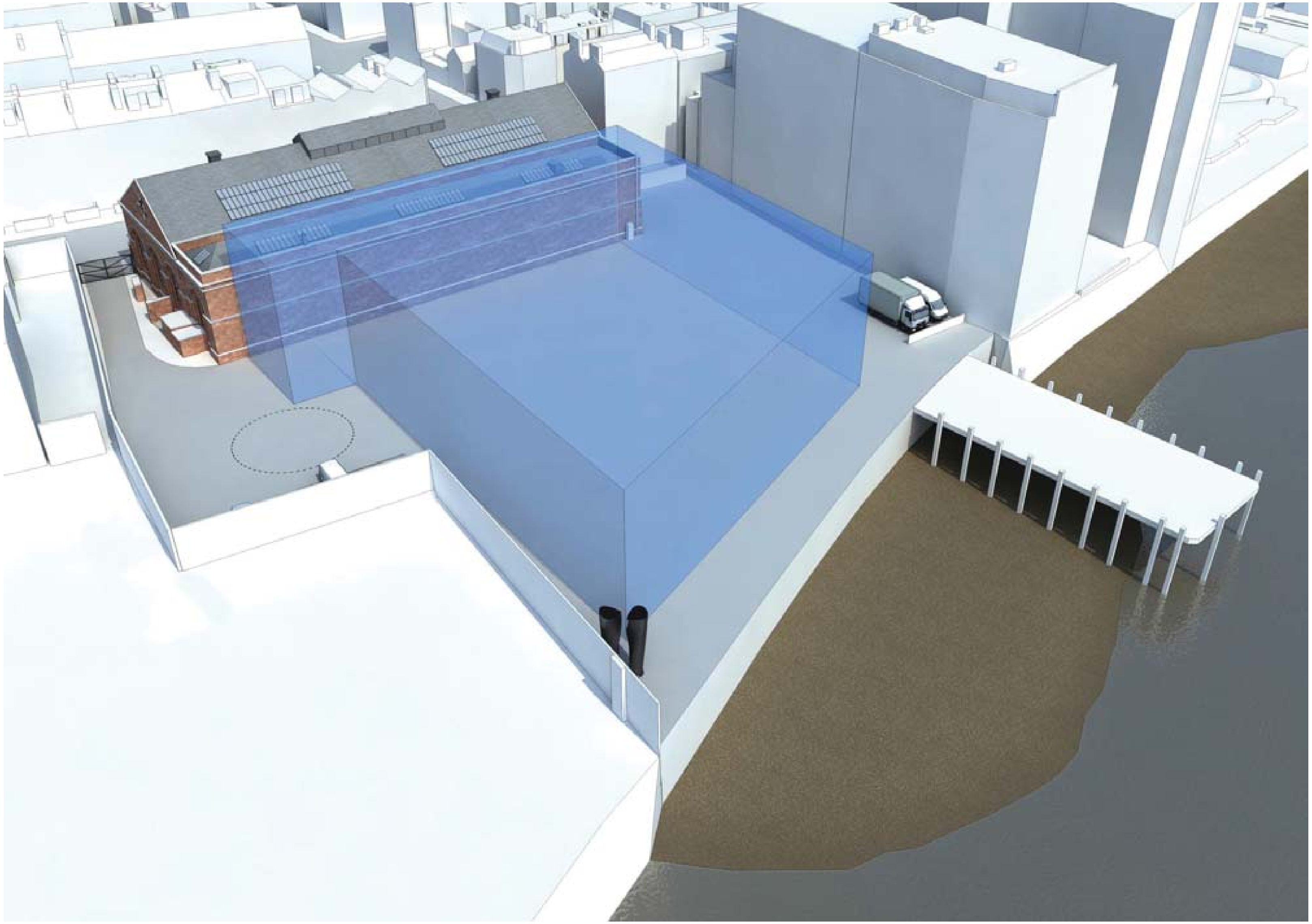


Figure 14.6 Cremorne Wharf Depot site - illustrative aerial view



14.3 Effects of the proposed development at the Cremorne Wharf Depot site on the environment

Introduction

14.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

14.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of the Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

14.3.3 The following section describes the likely significant effects (both beneficial and adverse) arising from the proposed development at the Cremorne Wharf Depot site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 12 of the *Environmental Statement*.

Effects during construction

14.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tug boats (for river barges) that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and recreational areas such as the adjacent Thames Path and nearby Cremorne Gardens. However, based on a computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on local residents, nearby commercial building occupants or those using the area around the site for recreation. This is due to the small increase in pollutant concentrations predicted.

14.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

14.3.6 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. In terms of noise effects from construction works on site, the presence of control measures such as site enclosures and temporary stockpiles to provide acoustic screening would help reduce noise at some receptors. However, significant adverse effects are predicted at the following residential properties due to the construction works: Station House and the mid-rise and high-rise buildings of the Lots Road Power Station development. It is not possible to further reduce the noise effects through on site controls. The residents of the properties affected may be eligible for compensation under the *Thames Tideway Tunnel compensation programme*.

14.3.7 In terms of noise from road and river-based construction traffic, effects would not be significant given the small changes in traffic noise levels predicted at nearby sensitive properties.

14.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

14.3.9 In terms of townscape, significant adverse effects on the site are likely due to the change to the setting of the area. People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects (ie, effects on their experience of views). A significant adverse effect is predicted on recreational viewpoint (view southwest from the pier of Cremorne Riverside Activity Centre) due to the visibility of construction activity immediately adjacent to the river. No other viewpoints are predicted to experience significant effects due to construction works only being partially visible or in the background filtered through trees and buildings or due to distance.

14.3.10 Consideration of the amenity of residents and other local land uses including users of the nearby Thames Path, Cremorne Gardens (Figure 14.8) and Cremorne Riverside Activity Centre is provided in the assessment of socio-economics. This takes into account the findings of the noise, vibration, air quality, construction dust and visual assessments. Due to the predicted noise effects, an adverse significant effect on the amenity of residents is predicted. No adverse effects are however predicted for the users of the Thames Path, Cremorne Gardens and Cremorne Riverside Activity Centre.

Figure 14.7 View from river towards Cremorne Gardens

14.3.11 The measures proposed as part of the project to minimise disruption and ensure safety of road users, pedestrians and cyclists would ensure that no significant transport effects would occur at Cremorne Wharf Depot site. This includes effects on river users which would not be significant.

14.3.12 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up (Figure 14.8). Construction work on site would involve changes to both above ground features as well as the environment below ground.

14.3.13 Information gathering has revealed that there is a low to high probability of below ground heritage assets being present. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

14.3.14 The site and its immediate surrounding were assessed to identify above ground features of interest, including, the Lots Road Pumping Station and Chelsea Wharf. No significant effects on historical features above ground are predicted.

Figure 14.8 North elevation of the Grade II listed Lots Road Pumping Station

14.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The site has been subject to a number of potentially contaminative current and historical land-uses, such as a council depot which was previously used as waste management depot, a rubber works, pumping station and wharf. Surrounding contaminative land uses include a coal and later oil fired power station, wharves and fuel storage. No likely significant effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

14.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the water (commonly termed a ‘pathway’) is created, resulting in the mobilisation of pollution. At the Cremorne Wharf Depot site, measures such as bunded fuel stores to reduce the risk of spills and treatment of water from the excavations would be implemented to ensure there would be no significant effects on groundwater resources or quality.

14.3.17 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. At the Cremorne Wharf Depot site a route for pollutants to enter the water may arise during the upgrade of the existing campshed in the River Thames. Another route for pollutants could be from substances used in construction (for example oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants getting into the river in this way. Pollutants would either go into existing drains or be collected on site. Based on the application of these measures, no significant effects on surface water would occur.

14.3.18 Flooding may occur from various sources for example, tidal and fluvial sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, fluvial, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, the finding of the flood risk assessment for the site is that there would be no change in flood risk during construction and there would be no significant effect in respect of flood risk

14.3.19 The River Thames provides an important habitat for river ecology (Figure 14.9). The construction site at Cremorne Wharf Depot would be located on land. The only in-river works associated with this site are the use of an upgraded campshed by barges for removing excavated materials. Given the small extent of the works relative to the width of the channel and temporary nature of the works, no likely significant adverse effects on aquatic ecology are predicted.

Figure 14.9 Surveys for river ecology

14.3.20 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including noise screening and avoiding direct lighting of the river. No significant adverse effects are therefore predicted. These control measures would also prevent significant adverse effects on wintering birds and bats for which the River Thames foreshore provides habitat.

14.3.21 The Cremorne Wharf Depot site is an environment that is of limited value to land based ecology. As such, the removal of one tree and the shrub in the southeast of the site, and the demolition of existing buildings on site would not have likely significant effects on land based ecology.

14.3.22 The topic assessments have considered other developments that are planned nearby during the same timeframe that would interact with the construction work at the Cremorne Wharf Depot site. Cumulative adverse effects are predicted in relation to air quality, townscape and certain viewpoints when the construction of the Lots Road Power Station development is considered in the assessment. No other likely significant cumulative effects have been identified.

Effects during operation

14.3.23 The operational site would include an underground air treatment chamber connected to the ventilation columns. The below-ground air treatment chamber would include filters that would remove any odours from the air to be released. The height of the ventilation columns (at between 4m and 8m) would allow the elevated release of expelled air. This would ensure that there are no significant effects from odour during operation.

14.3.24 Noise and vibration from operational plant at above-ground structures, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Plant equipment would be located within the pumping station building and therefore would be shielded with an acoustic surround. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground and a number of structures provide a barrier to noise and vibration, there would be no significant effect. During maintenance visits, there would be very low numbers of vehicles required and there would be minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely at this site during operation.

14.3.25 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. Maintenance visits would lead to some temporary, short-term delay to users of the local road network, which would not be significant.

14.3.26 The scale and form of the proposed development at this site is similar to the existing arrangement. The improved design and materials, and the general landscape treatment would result in beneficial effects on the character, appearance and setting of above-ground heritage assets, including the designated Grade II Lots Road Pumping Station and the Thames Conservation Area. These improvements would not however be significant.

14.3.27 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

14.3.28 Groundwater levels and quality could theoretically be affected by seepage into and out of the shaft. The risk of this in both cases would be low due to the construction techniques and materials used and therefore no significant effects would occur. The presence of below ground structures may alter the local movement and level of groundwater. Assessment indicates however that there would be no significant rise in groundwater levels related to the presence of the new structures.

14.3.29 As described above, the development at Cremorne Wharf Depot would intercept the Lots Road Pumping Station sewer overflow during storms that would otherwise discharge to the tidal Thames at this location. The proposals at the site would remove almost all the discharges from this sewer. As a result, there would be significant improvements to water quality.

14.3.30 Associated with the improvements in water quality would be significant beneficial effects on the river based ecology. Fish and invertebrate would benefit from the reduced pollution, leading to an increase in numbers and species diversity.

14.3.31 The fully built project would also not alter the existing flood risks and therefore operational effects would not be significant.

14.3.32 The proposed presence of operational structures and hardstanding would restrict the use of a limited portion of land within the Cremorne Wharf Depot site for employment generating uses. However, this would not result in a significant effect in respect of socio-economics.

14.3.33 The only nearby development that could interact with the operation of the project is the Cremorne Wharf development which would be constructed on the Cremorne Wharf Depot site (taking account of the Thames Tideway Tunnel operational structures). However, no significant cumulative effects have been identified.

14.3.34 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no effects in terms of contaminated land and so land quality effects during operation have not been assessed.

c. Given that there would be no additional permanent lighting incorporated into the design, and the infrequent maintenance requirements, no significant effects on land based ecology are likely and therefore this has not been assessed.

d. Operational effects on townscape character and viewpoints have not been assessed on the basis that the proposed changes in operation would be limited and unlikely to have significant effects.

14.4 Further information

14.4.1 Further information regarding the assessment of the Cremorne Wharf Depot site can be found in Volume 12 of the *Environmental Statement*.

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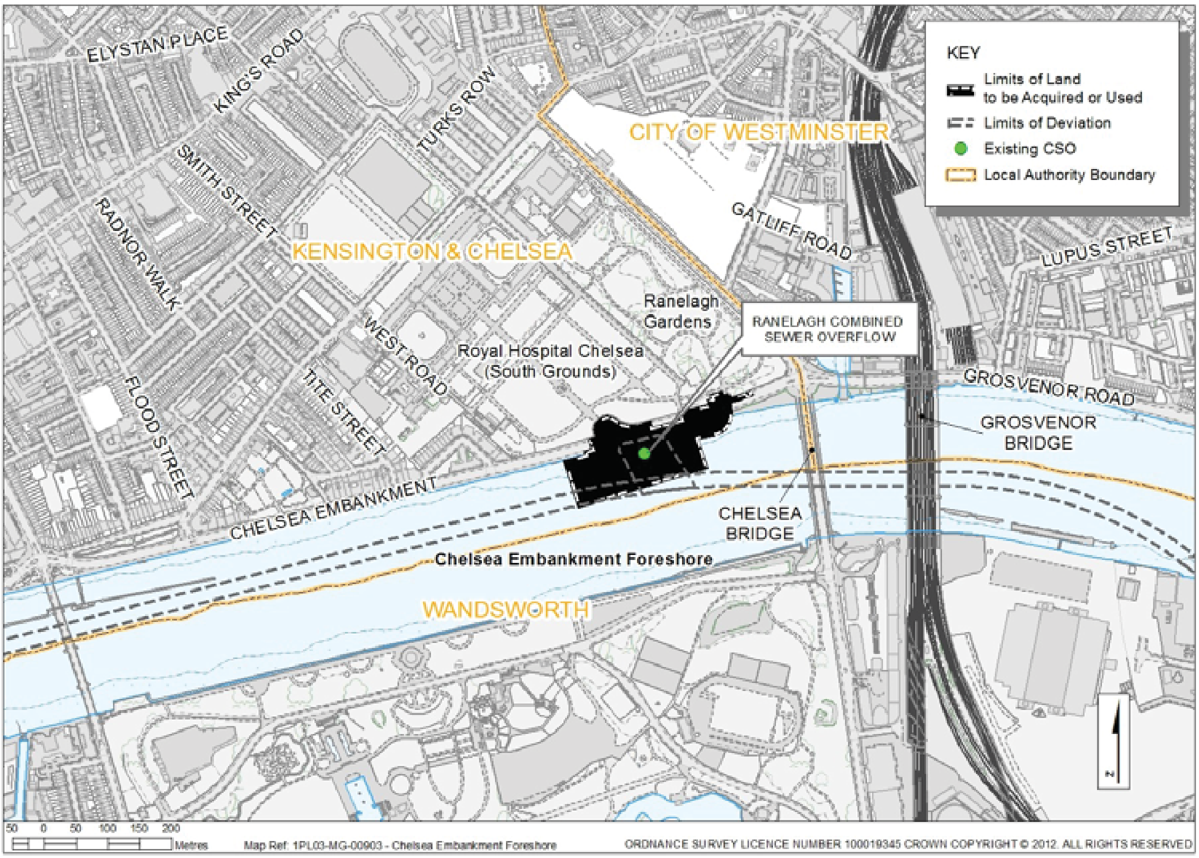
15 Chelsea Embankment Foreshore

15.1 Existing site context

15.1.1 The proposed development site is located in the Royal Borough of Kensington and Chelsea on the northern bank of the River Thames. It comprises an area of the River Thames foreshore, a section of footway and carriageway of Chelsea Embankment (A3212), and a small part of Ranelagh Gardens. The Ranelagh combined sewer overflow currently discharges into the River Thames along this section of the Chelsea Embankment.

15.1.2 The site is bounded to the north by Chelsea Embankment, the Royal Hospital Chelsea and its South Grounds, and Ranelagh Gardens. The River Thames bounds the site to the east, south and west.

Figure 15.1[1] Location of proposed Chelsea Embankment Foreshore site



15.1.3 The surrounding area is predominately open space and residential properties. The nearest dwellings are to the west on Embankment

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Gardens, to the northeast along Chelsea Bridge Road, and the Royal Hospital Chelsea to the north of the site. Additionally the Lister Hospital is located to the northeast of the site. The Thames Path runs along the southern footway of Chelsea Embankment within the boundary of the proposed site. Figure 15.1 to Figure 15.3 show the site location and context.

15.1.4 There is no existing vehicle access to the foreshore site.

Figure 15.2 Aerial view of existing site

15.1.5 Air quality management designations have been made by the Royal Borough of Kensington and Chelsea which covers the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

15.1.6 The site is predominantly located within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation (SINC). In addition, Ranelagh Gardens SINC is adjacent to the northeast of the site.

15.1.7 The Grade II registered historic park and gardens (Royal Hospital Chelsea South Grounds and Ranelagh Gardens) are located immediately to the north of the site, as are the Grade II listed entrance gates (Bull Ring Gate) on Royal Hospital Road. Chelsea Embankment is not listed within the site, but is Grade II listed to the west of the site.

Figure 15.3 Chelsea Embankment Foreshore – site context

View from river looking north showing river wall and sewer outfall

View west along Chelsea Embankment

View looking downstream with site to the north

Gravel foreshore with Chelsea Bridge in the background

15.1.8 The majority of the site is located in the River Thames Conservation Area, whilst the inland sections of the site (the footway/carriageway of Chelsea Embankment and a small section of Ranelagh Gardens) are located within the Royal Hospital Conservation Area.

15.1.9 There are no other environmental designations on or adjacent to the site.

15.2 Proposed development

15.2.1 The purpose of this 2.5 hectare site would be to intercept the Ranelagh combined sewer overflow which currently discharges untreated sewage into the River Thames on average 26 times each year, at a total volume of 283,000m^3. This is equivalent to approximately 113 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, there would be approximately two discharges of untreated sewage into the River Thames per year from this combined sewer overflow.

15.2.2 The site would also be used to make a connection to another major sewer (called the Low Level Sewer No 1) under the footway and carriageway of Chelsea Embankment. This connection, as well as a connection to the

Low Level Sewer No 1 at two other sites (Victoria Embankment Foreshore and Blackfriars Bridge Foreshore), would control the flows within the wider sewer system. This would control the discharge of untreated sewage into the River Thames from ten other combined sewer overflows along the northern embankment, eliminating the need for works at these ten sites.

15.2.3 Construction at the Chelsea Embankment Foreshore site is assumed to start in 2017 and be complete by 2020. A shaft approximately 45 metres deep and with an internal diameter of approximately 12 metres would be constructed in a new area of reclaimed land in the River Thames foreshore in front of the existing river wall opposite Bull Ring Gate.

15.2.4 The temporary construction area of reclaimed land, called a cofferdam, would be constructed to enable a work site to be established and to enable the construction of the shaft and other structures. The cofferdam would be retained by steel piles or similar and built up to ensure that the site and surrounding area stay protected from flooding. The cofferdam would be filled up to existing ground level so that the site is directly accessible to vehicles from Chelsea Embankment.

15.2.5 Material used to fill in the cofferdam, and also excavated material arising from construction of the shaft and other structures, would be transported by barges, minimising the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

15.2.6 During construction, vehicles would access the foreshore site from a new access constructed from Chelsea Embankment. The average peak daily number of lorry trips at this site would be 42 and the average peak daily number of barges would be three.

15.2.7 Barges would moor on the southern side of the cofferdam, and would sit upon a concrete bed, or ‘campshed’, during periods of low tide.

15.2.8 In order to make the connection to the Low Level Sewer No.1, existing utilities (including gas, electricity and telecommunications) would need to be diverted out of the road into the edge of Ranelagh Gardens. This would require the temporary closure of part of the Chelsea Embankment carriageway. However, because of the width of the road, one lane of traffic in each direction would be maintained.

15.2.9 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

15.2.10 The plan below (Figure 15.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

15.2.11 To help explain this information, the schematic diagram below (Figure 15.5) illustrates where the structures may be located within these zones.

15.2.12 Terraces have been incorporated into the design of the permanent structure. The eastern terrace would cover over the structure connecting to the existing outfall, which would otherwise need to be built up to flood defence level. The western terrace provides a degree of symmetry to the structure, to balance the eastern terrace and improve the visual aspect of the design.

15.2.13 While most of the structures would be underground, two 4 to 8 metre high ventilation columns would be located on the new structure in the foreshore to provide ventilation of the shaft. In addition, smaller diameter 6 metre high ventilation columns would be located on the southern footway and northern footway of Chelsea Embankment to provide ventilation of the structures connecting to the existing outfall and the Low Level Sewer No 1 respectively.

15.2.14 The height of the new ventilation columns, in combination with filters included in the below ground structures, would control odour and minimise any effect on people using the Thames Path and Ranelagh Gardens. These are shown in an illustrative above-ground plan in Figure 15.6.

15.2.15 Below-ground equipment would be controlled by electrical and control equipment located within two kiosks. These would be integrated into the new river wall to reduce their visual effects.

15.2.16 Operational lighting of the foreshore structure would be minimal and would be designed to avoid light pollution and to respect the historic environment. Once operational, routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Access to the site would be from a new permanent access from Chelsea Embankment.

Figure 15.4 Proposed development at the Chelsea Embankment Foreshore site

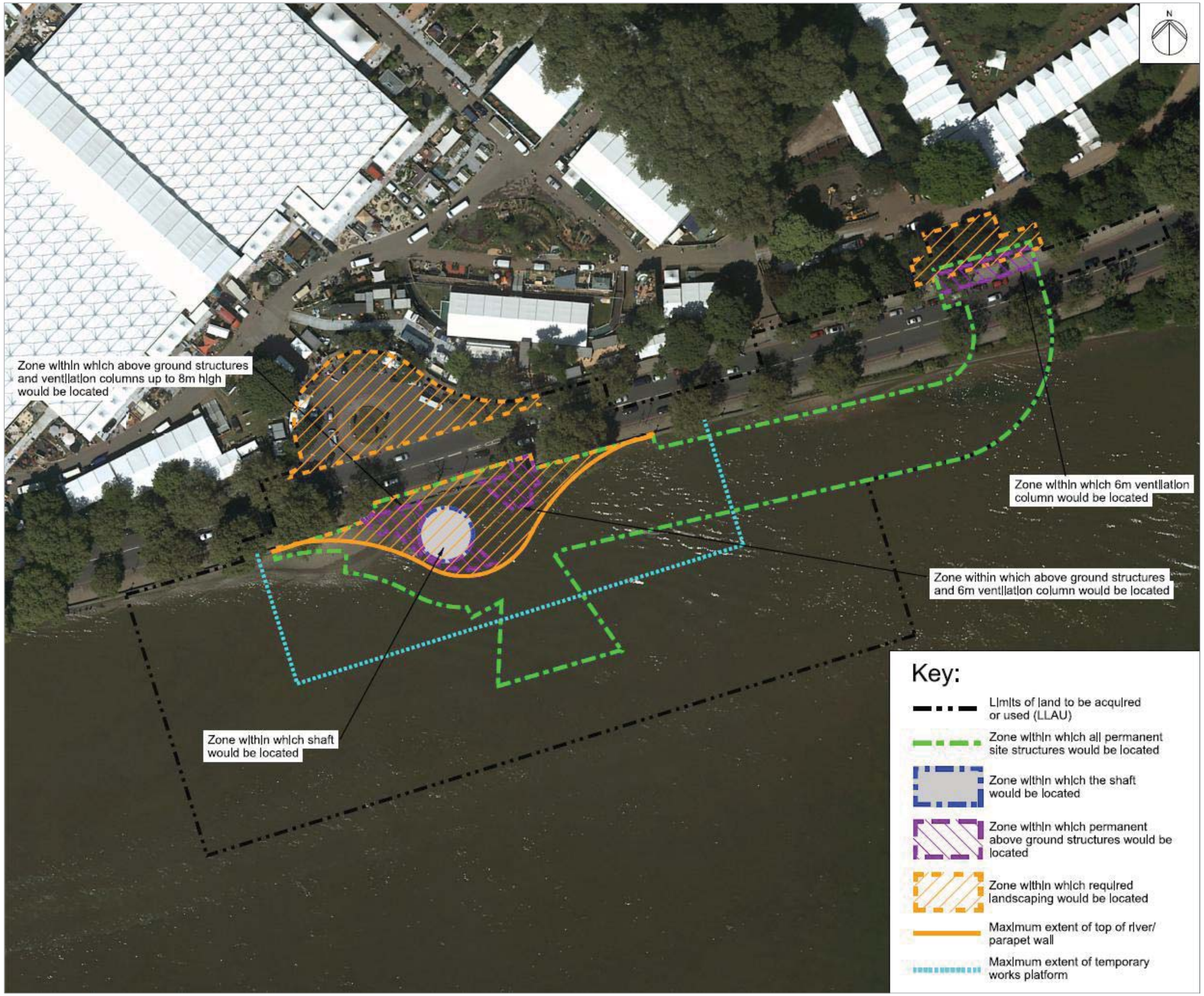


Figure 15.5 Schematic layout at the Chelsea Embankment Foreshore site

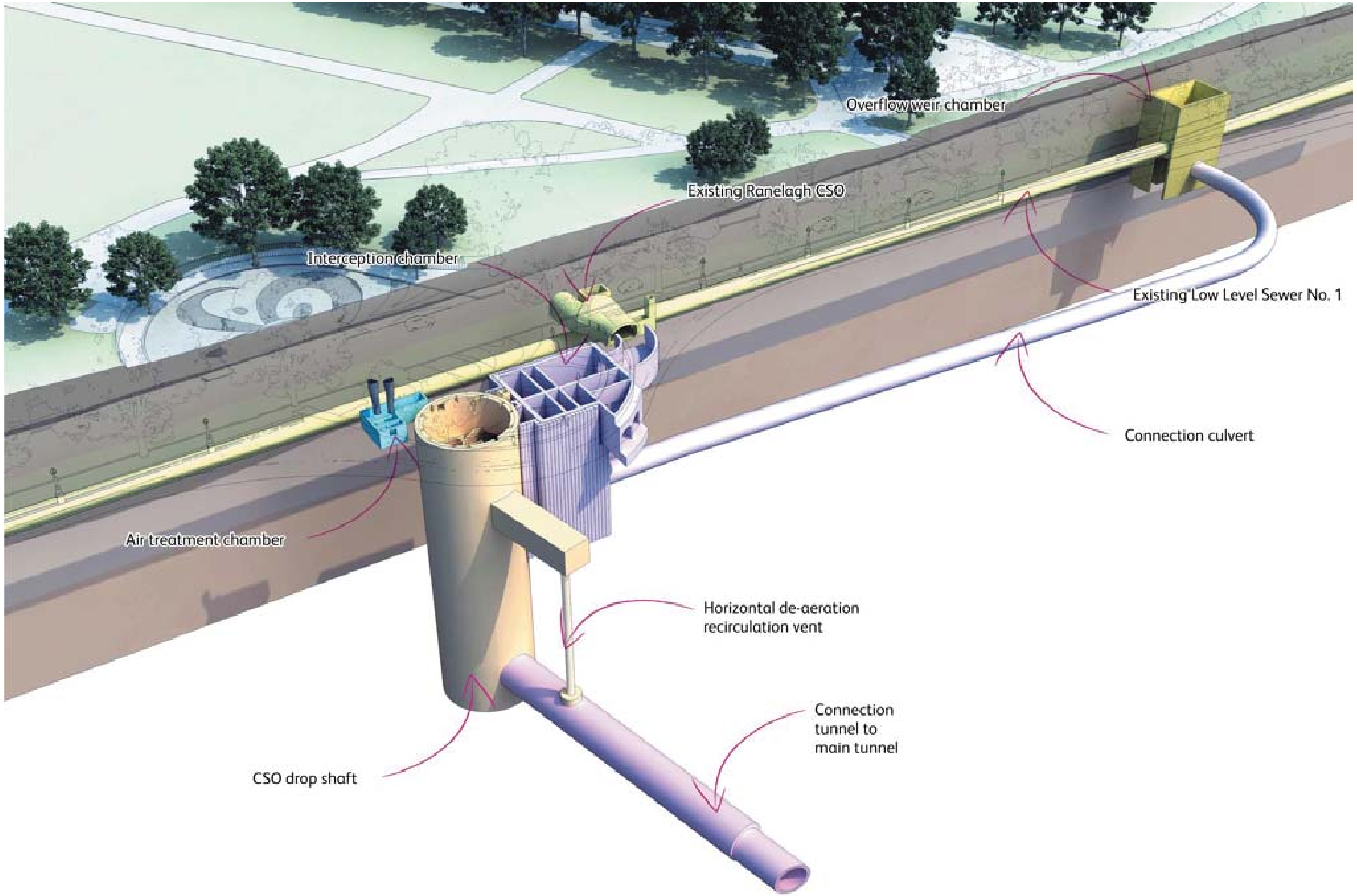


Figure 15.6 Chelsea Embankment Foreshore site – illustrative aerial view

15.3 Effects of the proposed development at Chelsea Embankment Foreshore on the environment

Introduction

15.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

15.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of the Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

15.3.3 The following section describes the likely significant effects (both beneficial and adverse) arising from the proposed development at the Chelsea Embankment Foreshore site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 13 of the *Environmental Statement*.

Effects during construction

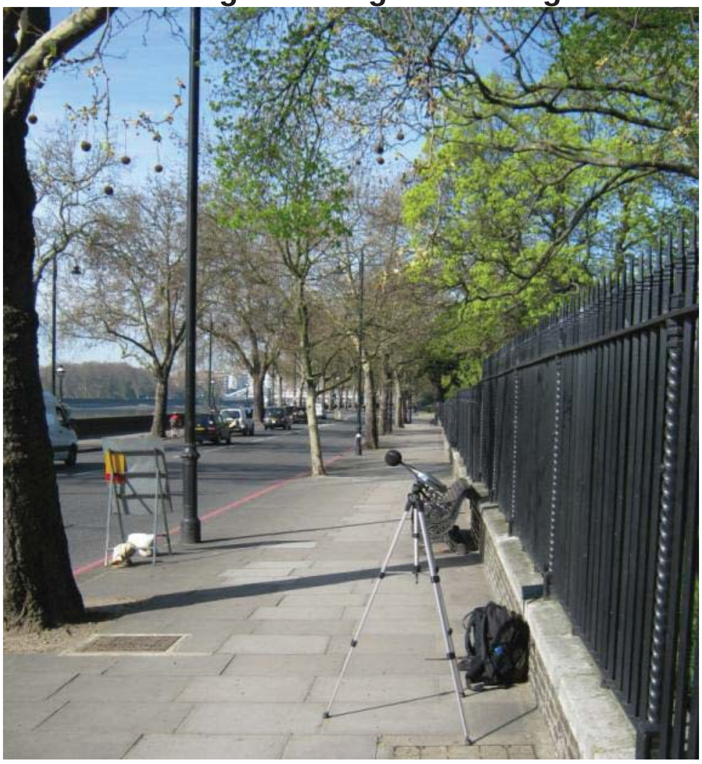
15.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tug boats (for river barges) that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties such as the Lister and Royal Chelsea Hospitals as well as people who use the adjacent Thames Path and open spaces (Ranelagh Gardens and Royal Hospital Gardens) for recreation. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on local residents, hospitals or those using the area around the site for recreation. This is due to the small increase in pollutant concentrations predicted.

15.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

15.3.6 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. In terms of noise effects from construction works on site, the presence of control measures, such as site enclosures and temporary stockpiles to provide acoustic screening, would help reduce noise at some receptors. No significant noise effects from construction works on site are predicted on either residential or non-residential properties or users of the local area. Similarly, no significant noise effects from construction traffic (either road-based or river-based) are expected given the small predicted changes in traffic noise levels.

15.3.7 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

Figure 15.7 Noise monitoring – looking west along Chelsea Embankment



15.3.8 In terms of townscape, significant adverse effects around the Chelsea Embankment Foreshore site are likely. This is due to the change to the area from the clearance required to form the construction site, the formation of the construction working area in the river and the level of activity during construction.

15.3.9 People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects, that is effects on their experience of views. Significant adverse effects are likely from a number of viewpoints. This is largely due to the unobstructed visibility of the temporary construction working area located in the river and the construction activities. Panoramic views over the river would also be affected by the combined effects of construction works at the Chelsea Embankment Foreshore, Kirtling Street, Heathwall Pumping Station and Albert Embankment Foreshore sites given their proximity to each other.

15.3.10 Consideration of the amenity of local residents, businesses and users of the nearby Thames Path, Ranelagh Gardens and the Royal Hospital Gardens is provided in the assessment of socio-economics. This takes into account the noise, vibration, air quality, construction dust and visual effects on local amenity. Given that the only significant effects identified are from the adverse visual effects of the construction site, and that some of these views would be screened, the effects on amenity would not be significant.

15.3.11 The measures proposed as part of the project to minimise disruption and ensure safety of road users (Figure 15.8), pedestrians and cyclists would ensure that likely significant transport effects are minimised. The only likely significant adverse effects would be on pedestrians and local residents using the Thames Path due to the temporary footpath diversions which would be necessary to allow safe movement of construction vehicles to and from the site. Effects on river users would not be significant.

Figure 15.8 View northwards to Grade II registered Royal Hospital

15.3.12 A study of historical maps, previous archaeological records and research into local history has been undertaken to build up a picture of the possible below ground remains (Figure 15.9). Construction works would involve changes to both above ground features as well as the environment below ground.

15.3.13 Information gathering has revealed that there is potential for prehistoric, post-medieval, and 18th and 19th century, remains at this site. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

Figure 15.9 A view of the Royal Hospital Chelsea and the Rotunda in Ranelagh Gardens: 1744 (Image 143225 © Museum of London)

15.3.14 There are significant effects predicted on a number of neighbouring Conservation Areas and above ground historical features (for example, Chelsea Bridge) due to the change to their historic character and setting caused by the construction works.

15.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The site and near site area has not been subject to any major contaminative past land uses. No significant effects have therefore been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

15.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created, resulting in pollution. At this site, the pressure of the groundwater could interfere with the construction of the shaft by causing the base of the shaft to move upwards. To prevent this happening, the construction of the shaft would involve pressing a 'ring' made up of concrete segments into the ground to form the shaft and to provide cut-off of any groundwater inflows. The shaft construction methods used would not lead to the removal of water from the upper aquifer and there would be no mobilisation of pollution at this site. Given this, no likely significant effects on groundwater resources or quality would occur.

15.3.17 As with groundwater, surface water quality can also be affected by pollution. At this site, while there is potential for pollutants to enter surface water, for example during construction works taking place in the river, there would be control measures in place to avoid this. As a result, pollutants would either go into existing drains or be collected on site. Based on the application of these measures, no significant effects on surface water would occur.

15.3.18 The construction of a temporary working area in the foreshore of the River Thames at this location would lead to some changes in the flow of water in the river. This may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

15.3.19 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river, surface water and sewer flooding at the site. The proposed development could change the level of risk associated with all sources of flooding. However, the cofferdam would be constructed in the foreshore to the same height as the existing flood defence. Based on the assessment, there would be no change in flood risk as a result of construction works.

15.3.20 The River Thames provides an important habitat for river ecology. As most of the construction works at the Chelsea Embankment Foreshore site would take place within the river, this may have an ecological effect. The total temporary landtake from habitats within the river from temporary construction works in the river would be a small percentage of the total area of the River Thames and its tributaries, which are designated for their nature conservation value. As such, no significant effects due to landtake are predicted on river habitats and associated species of plants and animals. There is also likely to be some disturbance of habitats and species due to barge movements but as this would be over a limited area, no significant effects are predicted. As described in paragraph 15.3.18, while there are likely to be localised changes in the flow of water in the river, the limited extent of this is not predicted to result in significant effects on river based ecology.

15.3.21 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including noise screening and avoiding direct lighting of the river. No significant adverse effects are therefore predicted. These control measures would also prevent significant adverse effects on land based ecology such as wintering birds and bats, for which the River Thames provides habitat.

15.3.22 The assessment has considered other developments that are planned within the vicinity of this site during the same timeframe and which could interact with the construction work at the Chelsea Embankment Foreshore site. Significant adverse cumulative townscape and visual effects have been identified at one of the viewpoints and one character area from construction of the Battersea Power Station development. No other likely significant cumulative effects have been identified.

Effects during operation

15.3.23 The operational site would include an underground air treatment chamber connected to two new ventilation columns (each 4 to 8 metres in height). The below-ground air treatment chamber would include filters that would remove any odours from the air to be released. The height of the ventilation columns would allow the elevated release of expelled air. This would ensure that there are no likely significant effects from odour during operation.

15.3.24 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic have been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

15.3.25 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. Space to locate the cranes may require the temporary diversion of the Thames Path. The ten yearly maintenance visits may also lead to some temporary, short-term delay to users of the local road network. However, these operational activities would not lead to significant effects.

15.3.26 Significant adverse effects on the character of the site and the townscape around the site along the river are predicted (Figure 15.10). This is due to the change in the character and setting of the area from the new foreshore structure and above ground structures which would project into an open stretch of river. Most viewpoints would however experience no significant effects. The only significant adverse effect would be on the view from the northern end of Chelsea Bridge towards the site due to the visibility of the foreshore structure and above-ground structures projecting into the river, which is currently characterised by a long uninterrupted sweep.

15.3.27 The extension of the river wall out in to the foreshore would result in the permanent provision of an area of pleasantly landscaped and functional public amenity space which would result in a beneficial effect on local amenity. However, the size and functionality of the space would be limited in an area which already has a high provision of parks and as such this beneficial effect is not predicted to be significant.

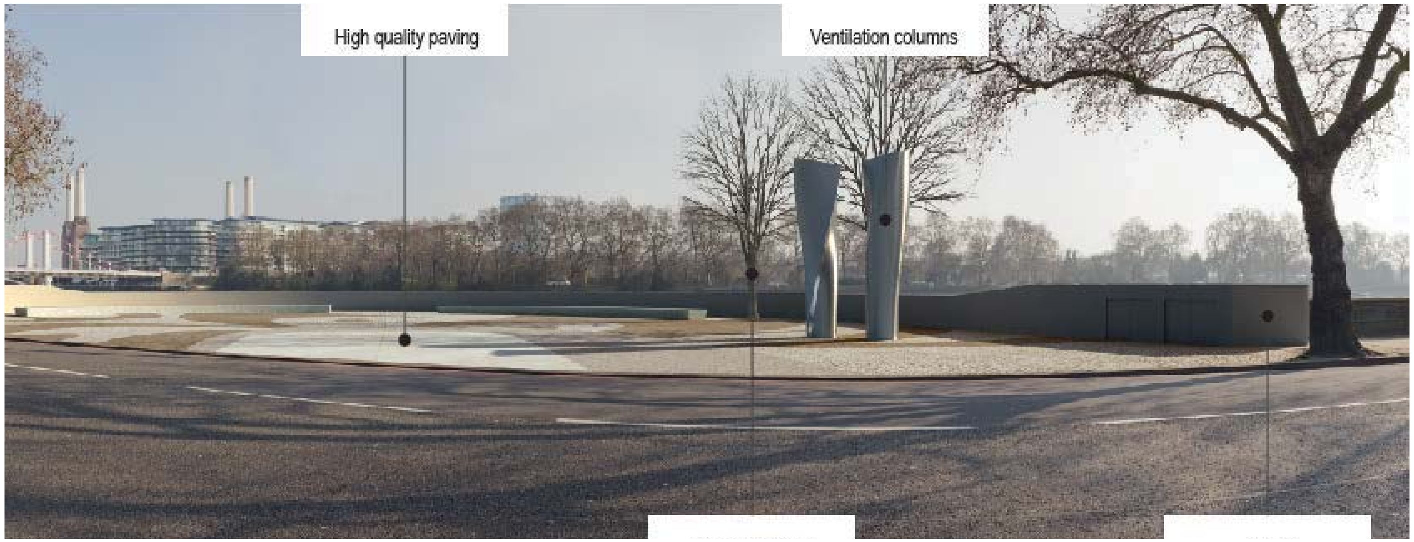
15.3.28 The above ground operational structures would have significant adverse effects on nearby heritage assets and conservation areas including Chelsea Bridge. As with townscape, this is due to the projection into the River Thames of the permanent foreshore structure and also the removal of several lamp standards. The public space created by the foreshore structure would have beneficial effects upon the character of neighbouring conservation areas and some listed buildings, including Chelsea Hospital. This is due to the expanded and improved public space from which to view listed buildings and the restored emphasis on their historic character and original connection to the river.

15.3.29 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

15.3.30 The proposed permanent structures at this site have the potential to affect the movement of water within the river, and consequently deposition and erosion of sediments. However, protective measures for any affected structures would be included in the operational development. No significant adverse effects are therefore predicted.

15.3.31 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected. It would remove almost all the discharges, resulting in significant benefits to water quality.

Figure 15.10 Existing site and illustrative visualisation with the proposed development at the Chelsea Embankment Foreshore site



15.3.32 Associated with the improvement in water quality, would be significant beneficial effects on river based ecology. Sewage in the river leads to high levels of bacteria which remove oxygen from the water, leading to the death of fish. Reduced levels of sewage would mean this would happen far less often, resulting in a significant beneficial effect on fish populations. It is also likely that there would be significant beneficial effects from an increase in pollution sensitive fish species and an improvement in the quality of foraging habitat for fish.

15.3.33 The permanent loss of foreshore habitat would have a significant adverse effect on river habitats. To compensate for this, and other Thames Tideway Tunnel sites where permanent works in the river are proposed, a series of compensation measures have been developed. These include schemes to improve access to or creation of habitats elsewhere along the River Thames and its tidal tributaries.

15.3.34 The fully built project would also not alter the existing flood risk and the site would be defended by new flood defences. Therefore the operational flood risk effects would not be significant.

15.3.35 The assessments have considered other developments that are planned nearby that would interact with the operation of the development site. No likely significant cumulative effects have been identified.

15.3.36 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no likely significant effects in terms of land based ecology or land quality and therefore these topics have not been assessed.

15.4 Further information

15.4.1 Further information regarding the assessment of the Chelsea Embankment Foreshore site can be found in Volume 13 of the *Environmental Statement*.

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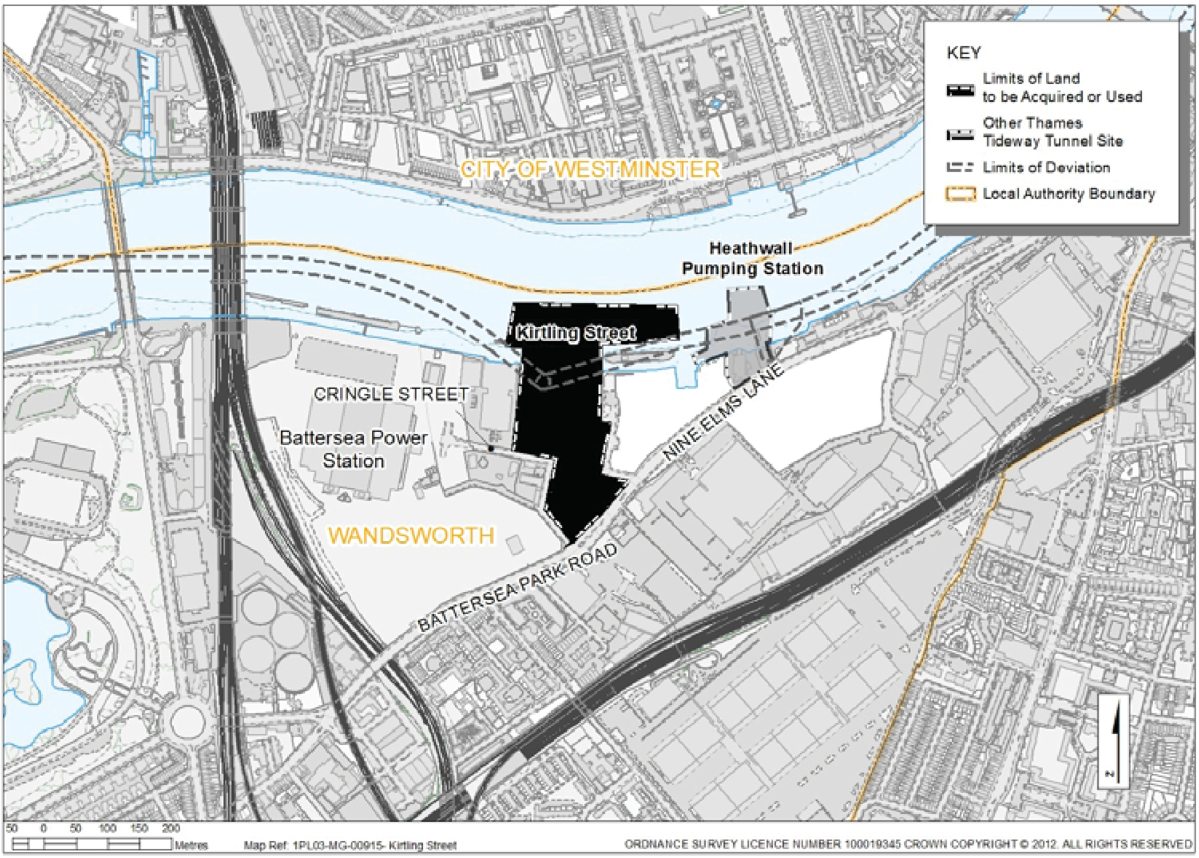
16 Kirtling Street

16.1 Existing site context

16.1.1 The proposed development site is located in the London Borough of Wandsworth on the southern bank of the River Thames. The site comprises four areas of land as well as an area extending into the River Thames.

Figure 16.1[1] Location of proposed Kirtling Street site



16.1.2 The side is bounded to the north by the River Thames. The southern area of the site is bounded by Kirtling Street, Cringle Street and Nine Elms Lane. Within the site to the north is a former depot, bounded by Cringle Street to the south and Kirtling Street to the west, north and east. Further north is a depository used by the Victoria and Albert Museum which fronts onto the River Thames. Immediately west and extending south as far as Cringle Street is a concrete batching plant occupied by Cemex. The batching plant includes a jetty at the safeguarded Kirtling Wharf (also known as Cringle Wharf) which falls within the riverward portion of the proposed development site.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Figure 16.2 Aerial view of existing site

16.1.3 The surrounding area is predominantly industrial and mixed-use. The nearest dwellings are houseboats adjacent to the northeast site boundary, and housing to the south of the site across Nine Elms Lane. Figure 16.3 shows the site and local context.

16.1.4 Existing access to the site is from Nine Elms Lane, Battersea Park Road via Cringle Street, and Kirtling Street.

16.1.5 An air quality management designation has been made by the London Borough of Wandsworth covering the whole Borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

16.1.6 The foreshore area of the site falls within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation. The Battersea Power Station Site of Importance for Nature Conservation is located immediately to the west of Kirtling Street and south of Cringle Street.

16.1.7 The Grade II listed Battersea Pumping Station, and the decommissioned Grade II* Battersea Power Station are located to the west of the site. A large section of the site also falls within the Wandsworth Archaeological Priority Area. There are no other environmental designations on or adjacent to the site.

Figure 16.3 Kirtling Street – site context

View of Cemex plant with Grade II* Battersea Power Station in the background

House boats moored at Tideway Wharf

Cemex plant

Battersea Park Road

16.2 Proposed development

16.2.1 The purpose of this 5.2 hectare site would be to construct two sections of the main tunnel – west to the site at Carnwath Road Riverside and east to the site at Chambers Wharf. There are no combined sewer overflows at this site, so there would be no connection to the existing sewerage system.

16.2.2 Construction at the Kirtling Street site is assumed to start in 2016 and be complete by 2022.

16.2.3 A shaft approximately 48 metres deep with an internal diameter of approximately 30 metres would be constructed on the northern half of the safeguarded wharf (Kirtling Wharf) currently used by Cemex as a concrete batching works.

16.2.4 Two sections of the main tunnel would be built in opposite directions from this site using tunnel boring machines. These machines would be lowered into the shaft, one after the other, and once underway, would be used to construct the two sections of tunnel at the same time. Once underway, tunnelling would be undertaken under 24 hour working to help make sure that the work is completed safely, efficiently and in the least time. The tunnel boring machines would progressively excavate the ground and line the tunnel with precast concrete ‘segments’. The excavated material would be transported via the shaft to the site and transported as described below. The segments would be joined together to make the circular outer lining of the tunnel. When the tunnel boring machines reach the shafts at Carnwath Road Riverside and Chambers Wharf, they would be dismantled at the base of the shafts and removed by crane at those sites. It has been assumed that an inner lining, called a secondary lining, would be constructed from Kirtling Street, by pumping wet concrete into temporary supports used to form the final inside shape of the tunnel.

16.2.5 The shaft at Kirtling Street would be used to take all excavated material out of the tunnel as the tunnel boring machines progress in opposite directions. It would also be used to deliver precast concrete segments and wet concrete to build the linings of the tunnel.

16.2.6 A temporary jetty would be built out into the river in front of the Cemex jetty to enable barges to be used during the construction period. The jetty would be located so that Cemex can continue to use its existing jetty. Excavated material arising from construction of the tunnel and sand and gravel used to make concrete for the inner lining of the tunnel would be transported using barges, minimising the number of lorry trips to and from the site. It is likely the jetty would still be under construction while the shaft is being built, so excavated material from the shaft itself (rather than the tunnel) would be transported by road rather than barge. The majority of materials would be transported to and from the site by barge. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

16.2.7 All construction would be controlled to reduce potential impacts. Measures would include an enclosure located over the shaft for the duration of 24 hour working to reduce noise effects on local residents. In addition, there would be other environmental controls in place throughout the construction phase to reduce potential impacts. These would include measures such as damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

16.2.8 In order to provide a safe working area, part of Kirtling Street would be closed to public access throughout the construction period. This would be used by construction vehicles and part of it would be shared with Cemex to provide access to their concrete batching plant which would be relocated to the southern area of the site to make room for the shaft.

16.2.9 Road access to the site would be from existing and new vehicle access points from Kirtling Street and Cringle Street. The average peak daily number of lorry trips at this site would be 96 and the average peak daily number of barges would be four.

16.2.10 The plan below (Figure 16.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

16.2.11 To help explain this information, the schematic diagram below (Figure 16.5) illustrates where the structures may be located within these zones.

16.2.12 While most of the structures would be underground, a single structure combining a ventilation column and electrical and control kiosk would be part of the permanent works. The structure would be 4 to 6 metres high and would provide ventilation of the shaft.

16.2.13 The height of this new structure, in combination with filters included in the below-ground structures, would control odour and minimise effects on surrounding residents. These above ground structures are shown in an illustrative above-ground plan in Figure 16.6.

16.2.14 The proposal includes the permanent relocation of the existing concrete batching plant to the southern half of the site. This would ensure that the shaft area remains accessible at all times and free of obstructions. Relocation of the concrete batching plant would involve the construction of new aggregate storage bins, silos, concrete batching plant, water tanks, bays, offices and other structures associated with the operational batching plant. Because a plant of the same capacity as the existing one is being relocated into a smaller area, some of the structures, notably the silos, need to be taller than existing (up to 30 metres).

16.2.15 Due to the industrial and operational nature of the concrete batching plant, no landscaping of the batching plant or the area around the shaft is proposed. Some streetscape improvements to Kirtling Street are proposed, including planting of trees and paving. The remainder of the site, which would not be required as part of the permanent works, would be secured by erecting hoarding and made available to others for future development.

16.2.16 No operational lighting would be provided, except for lighting as part of the concrete batching plant and a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

16.2.17 Once operational there would be routine inspections to the site every three to six months and important maintenance work carried out every ten years.

16.2.18 Access to and from the site and to the concrete batching plant would be from an existing access on Kirtling Street. Exit from the concrete batching plant would be from two new access points (modified from a single existing access) on Cringle Street.

Figure 16.4 Proposed development at the Kirtling Street site

Figure 16.5 Schematic layout at the Kirtling Street site

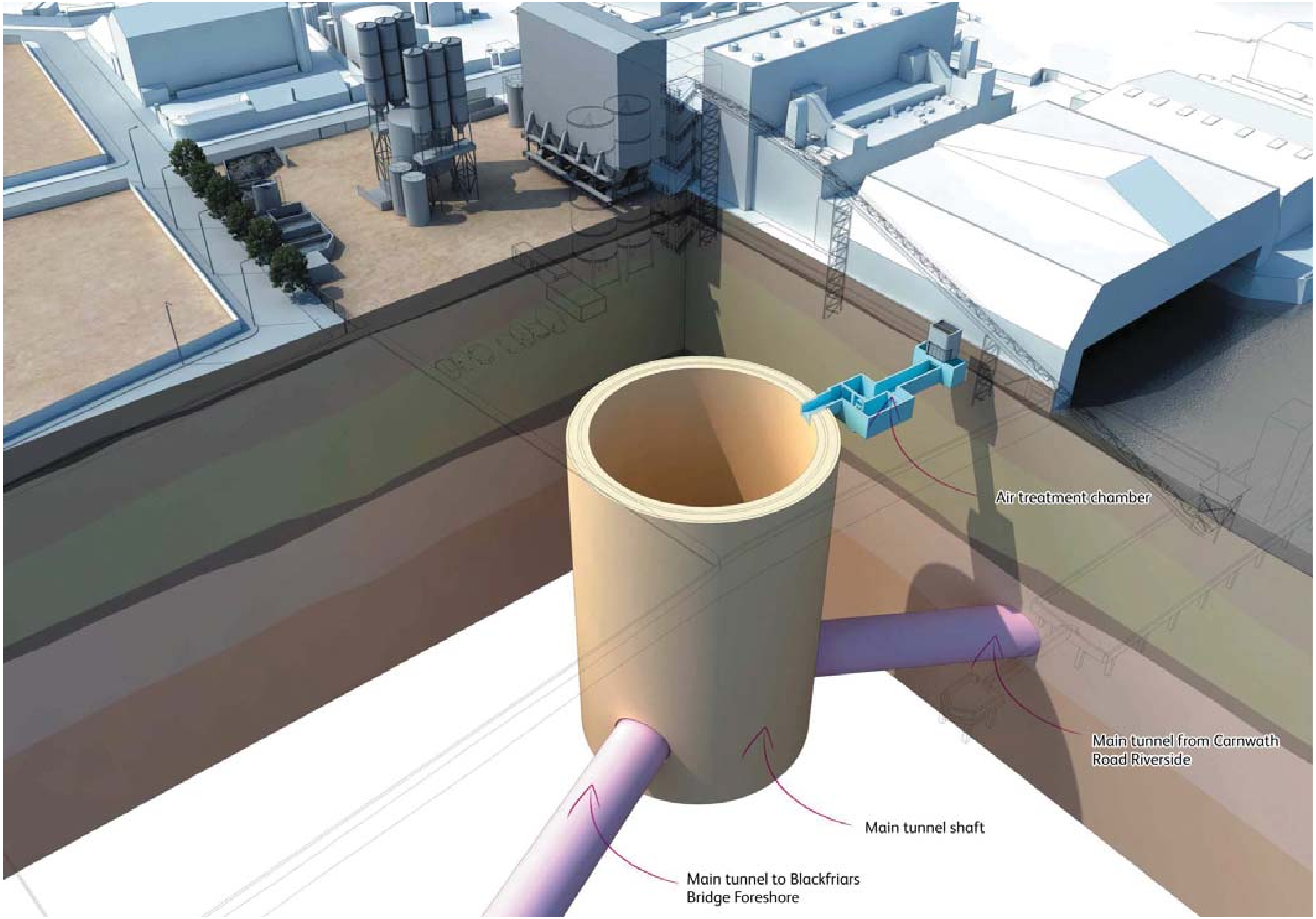


Figure 16.6 Kirtling Street site – illustrative aerial view

16.3 Effects of the proposed development at Kirtling Street on the environment

Introduction

16.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

16.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposal on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

16.3.3 The following section summarises the site effects (both beneficial and adverse) arising from the proposed development at the Kirtling Street site and explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 14 of the *Environmental Statement*.

Effects during construction

16.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles including barges that would be used to move materials for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents, including residents of the houseboats on Nine Elms Pier (Figure 16.7), and people who use the adjacent Thames Path for recreation. Pollutant levels are currently high across the London Borough of Wandsworth. Based computer modelling, it is predicted that pollutants associated with construction works would not result in significant effects on local residents, those using the area around the site for recreation or on businesses such as the industrial estate or New

Covent Garden Market. This is due to the small increase in emissions predicted.

16.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. Controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

16.3.6 Noise could arise from construction activities including the movement of tugs pulling river barges, construction traffic on roads outside the site and noise from equipment used on site.

16.3.7 Noise control measures would be put in place at the site during construction to minimise effects from construction activities. A noise enclosure over the shaft would help reduce noise at some receptors at night and at times when 24 hour working would be required. However, there would be significant adverse effects at a number of residential properties due to the construction works. The noise generating activities which would result in these effects would not occur continuously throughout the whole construction period.

16.3.8 It is not possible to further reduce the effects through on site controls. However, the residents of the properties that may be affected by noise may be eligible to apply for noise insulation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*, which if accepted, would reduce the effects to not significant. Residents of Nine Elms Pier houseboats may be eligible for temporary re-housing as noise insulation would not be appropriate for houseboats.

Figure 16.7 House boats moored at Tideway Wharf

16.3.9 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

16.3.10 In terms of townscape, significant adverse effects around the Kirtling Street site are predicted (Figure 16.10). This is due to the change to the setting from the introduction of construction activity including related activities at the adjacent Heathwall Pumping Station site.

16.3.11 Significant adverse effects are also predicted for a number of viewpoints. This is largely down to the visibility of the site and the presence of construction equipment including the river jetty at the Kirtling Street site and the cofferdam at the Heathwall Pumping Station site. These visual effects are predicted to take place during the day although generally not at night, as lighting at Kirtling Street would be barely perceptible from the majority of the viewpoints, with the exception of one viewpoint (a view west from the Riverlight development).

16.3.12 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account the noise, vibration, air quality, construction dust and visual assessments on local amenity including other local land uses including the nearby Thames Path. As significant adverse noise and visual effects are anticipated, the effects on the amenity of residents close to the site would be significant adverse. As explained above, residents affected by noise may be able to apply for noise insulation or temporary re-housing. Residents may also be eligible to apply for compensation through the *Thames Tideway Tunnel project compensation programme* which has been established to address claims of exceptional hardship or disturbance. No significant effects are predicted on the amenity of Thames Path users.

16.3.13 The measures proposed as part of the project to minimise disruption and ensure safety of river users, road users and pedestrians would ensure there would be no significant transport effects on most of these groups at the Kirtling Street site. However, a significant adverse effect would occur to pedestrians using the Thames Path and local highway network due to the temporary footpath diversions which are necessary to allow safe movement of construction vehicles. Local residents would also be affected by the pedestrian diversions which would increase their journey times. These diversions would only affect pedestrians and there would be no significant effects on river and road users.

16.3.14 A foreshore survey, study of historical maps, previous archaeological records and research into local history have been undertaken to build up a picture of the possible below ground remains. Construction work on site would involve changes to both above ground features as well as the environment below ground.

16.3.15 Information gathering has revealed that there is potential for prehistoric finds and Saxon and post-medieval remains being present. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

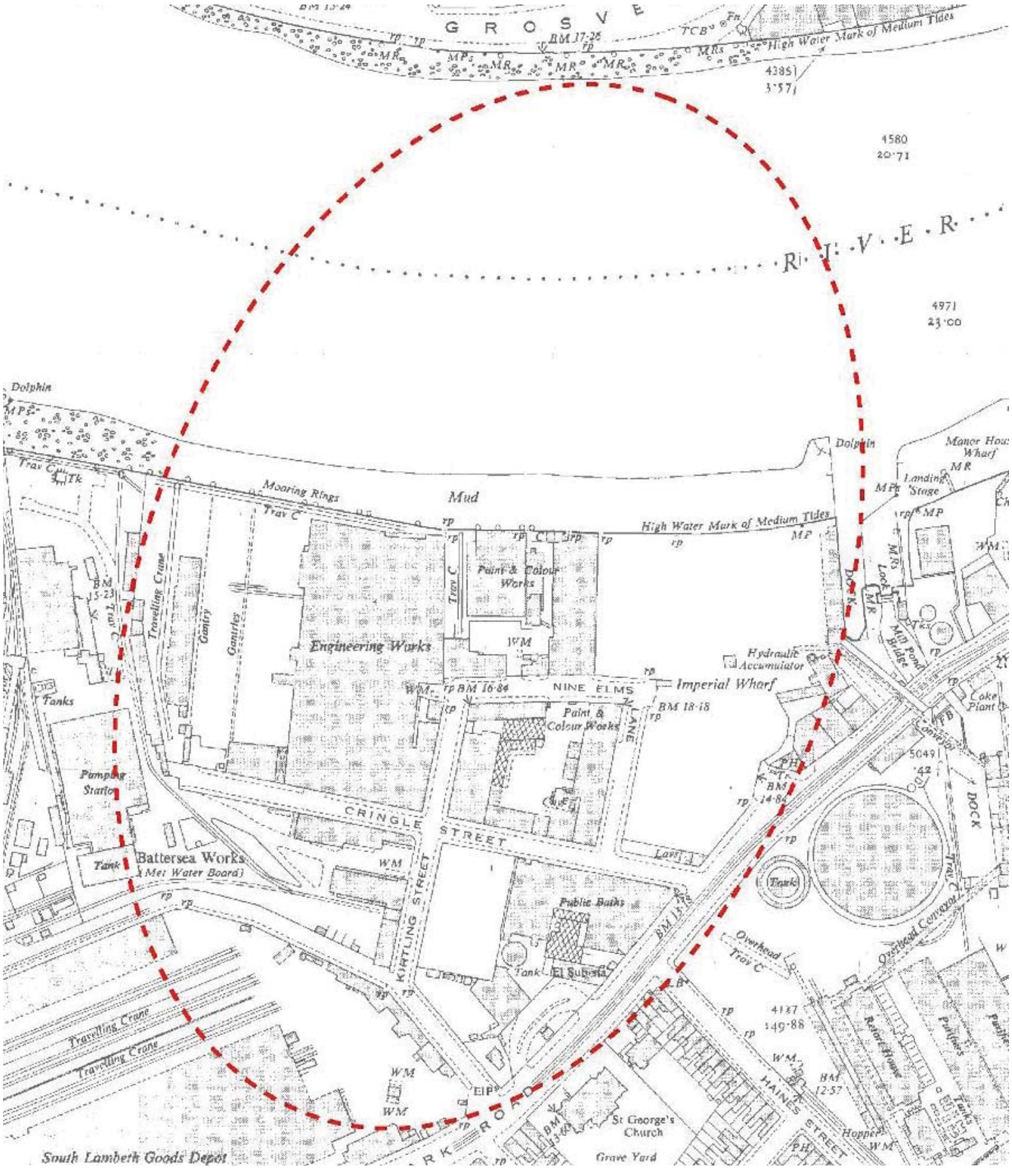
16.3.16 Above ground features that were identified include industrial buildings and an early electricity supply box on the pavement at the corner of Kirtling Street and Battersea Park Road (Figure 16.8).

Figure 16.8 Early electricity supply box

16.3.17 A group of buildings, understood to be from the late 19th century or early 20th century would be demolished to allow the site to be cleared for the construction works. The buildings would be surveyed and documented prior to demolition. Therefore there would be no significant effects on above ground historical features.

16.3.18 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could have resulted in contamination (Figure 16.9). This may in turn affect construction workers and adjacent premises if this material is disturbed during construction. The site has previously housed depots, warehouses and a garage and associated fuel filling station. These activities could have led to contamination of the ground although no significant effects have been predicted because workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

Figure 16.9 OS 25”: mile map of 1947 (not to scale)



16.3.19 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the water (commonly termed a ‘pathway’) is created, resulting in the mobilisation of pollution. At the Kirtling Street site the below ground structures would be at a depth where groundwater would be present. The pressure of the groundwater could interfere with the construction of the shaft by causing the base of the shaft to move upwards. To prevent this happening and to keep the below ground structures dry, groundwater would be pumped out of the structures and the below ground area where construction would take place (a process known as ‘dewatering’). Dewatering can affect groundwater in two main ways; either it can create a pathway for pollution or it can result in the lowering of groundwater levels, which could affect people who use the groundwater for water supply. A number of control measures would be applied to reduce dewatering effects; this includes limiting the amount of dewatering and stabilizing the ground to remove the pathway. Given the application of these measures, no significant effects on groundwater resources or quality would occur.

16.3.20 The local flow of groundwater could be affected by the presence of the new below ground structures. Taking into account the depth of groundwater below the surface at present, calculations have shown that below ground construction works would not have a significant effect on the movement and level of groundwater.

16.3.21 As with groundwater, surface water quality can also be affected by when pathways for pollutants are created. At the Kirtling Street site a route for pollutants to enter the water may arise during the construction of the jetty within the River Thames. This is because pollutants in the foreshore could be disturbed by excavations in the foreshore. Other routes for pollutants could be from substances used in construction (eg, oils) or from dewatering of groundwater (see above) draining into the river from the site. A number of control measures would be applied to prevent contaminated waters from draining straight into the river. Surface water from the site would either go to existing drains or be collected on site in tanks that would allow the pollutants to separate from the water before it is released into drains whilst groundwater from dewatering would be treated prior to release. Based on the application of these measures, no significant effects on surface water would occur. It is not anticipated that building the jetty would affect the water quality of the river as any contamination within the foreshore has probably already been diluted by the actions of tides in the River Thames.

16.3.22 Flooding may occur from various sources for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. Based on the assessment there would be no change in flood risk during construction and therefore no significant effects.

Figure 16.10 Existing site and visualization with construction works in place

16.3.23 The River Thames provides an important habitat for many species dependant on the river. As some of the construction works at the Kirtling Street site would take place within the river, this may have an effect on river based ecology. The construction of the jetty would mean that a small amount of river habitat would be lost. The jetty would also cause a small amount of shading over the river. As the jetty would be supported on steel piles this would not affect the flow of the river at the site. After construction, there would be reinstatement of the foreshore following removal of the jetty. Given that only small changes are anticipated to the river habitats, no significant effects have been identified on river based ecology.

16.3.24 The River Thames is also an important habitat for wintering birds and bats. The existing land-based part of the Kirtling Street site is an area that is of limited value to land based ecology and the clearance of shrubs and the existing buildings on site would not lead to significant effects. During construction control measures would be in including noise screening and minimising light spillage. The effects on species that use the site and immediate surrounds (including the foreshore), including birds and bats would be minimal and effects would not be significant.

16.3.25 The assessments have considered other developments that are planned nearby during the same time frame that would interact with the construction work at the Kirtling Street site. Significant cumulative noise and visual effects have been identified at some residential properties owing to a large amount of on-going construction in the area. It is also considered that there would be significant cumulative amenity effects on residential receptors near the site and users of the Thames Path. No other likely significant cumulative effects have been identified in the assessments.

Effects during operation

16.3.26 The operational site would include a 6 metre ventilation column whilst air treatment filters would also be installed to remove odour prior to release from the ventilation column. The height of the ventilation column would allow the elevated release of expelled air and therefore there would be no significant effect from odour.

16.3.27 Noise and vibration from operational plant, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and there would therefore also be no significant effect from noise from this source. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

16.3.28 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During main tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term temporary parking restrictions on adjacent roads to allow safe access to the site. This relatively minor operational activity would not lead to significant effects.

16.3.29 There would be no significant effects on the townscape character areas surrounding the site as features remaining on site would be well designed. No significant effects are expected at viewpoints as there would be few substantive changes in the views experienced.

16.3.30 Groundwater levels and quality could be affected by seepage into and out of the shaft, however the risk of this would be low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

16.3.31 The fully built project would also not alter the existing flood risk and therefore the operational flood risk effects would not be significant.

16.3.32 The design of the operational development could affect the setting of nearby heritage assets, namely Battersea Power Station. The operational developments at both the Kirtling Street and Heathwall Pumping Station sites would form a small part of views to Battersea Power Station from the east, south and west. As the developments would be in keeping with the existing industrial area, no significant effects are considered likely.

16.3.33 The assessments have considered other developments that are planned nearby that would interact with the operational development at the site. No significant operational cumulative effects have been identified in the assessments.

16.3.34 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, assessments of air quality and noise from traffic were not undertaken.

b. Operational activities would have no effects in terms of contaminated land or socio-economics and therefore effects on these aspects of the environment have not been assessed.

c. Given the limited area taken up by the operational site, the infrequent maintenance requirements and the fact that the design would involve minimal lighting, significant effects on land based ecology are not likely, and have not been assessed.

d. There would be no sewer interception at this site and so there would also be no significant effects on surface water or aquatic ecology at this site and they have not been assessed.

16.4 Further information

16.4.1 Further information regarding the assessment of the Kirtling Street site can be found in Volume 14 of the *Environmental Statement*.

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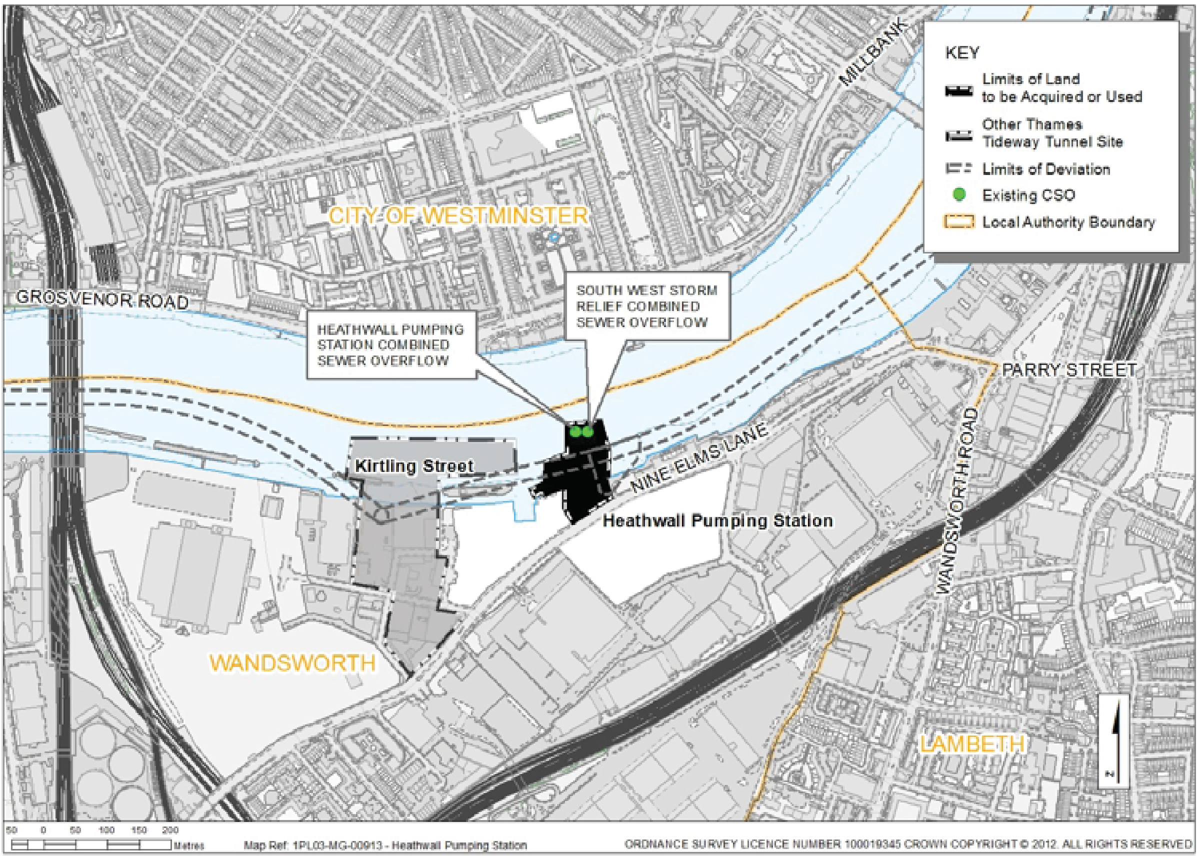
17 Heathwall Pumping Station

17.1 Existing site context

17.1.1 Heathwall Pumping Station is an existing Thames Water site located in the London Borough of Wandsworth. The proposed development site includes the existing pumping station, as well as Middle Wharf, which is designated as a safeguarded wharf.

17.1.2 The site is bounded to the north by the River Thames, to the east by open space, to the south by Nine Elms Lane, and to the west by the Riverlight (Tideway Industrial Estate) development (under construction). Further to the west lies the Thames Tideway Tunnel Kirtling Street site.

Figure 17.1[1] Location of proposed Heathwall Pumping Station site



17.1.3 The surrounding area is predominantly industrial and mixed-use. The nearest dwellings are the houseboats at Nine Elms Pier and the Tideway Walk development, and residences to the east of the site along Nine Elms Lane. Figure 17.2 to Figure 17.3 show the site location and context.

17.1.4 Existing access to the site is from Nine Elms Lane (A3205).

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

17.1.5 An air quality management designation has been made by the London Borough of Wandsworth, which covers the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

Figure 17.2 Aerial view of existing site

17.1.6 Part of the site falls within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation. The site also lies within the Wandsworth Archaeological Priority Area. There are no other environmental designations on or adjacent to the site.

Figure 17.3 Heathwall Pumping Station – site context

View from river towards Heathwall Pumping Station

Warning sign for storm outlet

View looking downstream towards site

View looking east towards the site

17.2 Proposed development

17.2.1 The purpose of this 1.3 hectare site would be to intercept two sewer overflows. One sewer overflow currently discharges untreated sewage into the River Thames on average 34 times each year, at a total volume of 655,000m^3. This is equivalent to approximately 260 Olympic sized swimming pools. The second sewer overflow currently discharges untreated sewage into the River Thames on average 13 times each year, at a total volume of 228,000m^3. This is equivalent to approximately 90 Olympic sized swimming pools.

17.2.2 Once the existing sewers are intercepted and with flows diverted into the proposed Thames Tideway Tunnel, there would be approximately four and one discharges of untreated sewage into the River Thames per year from these sewer overflows.

17.2.3 Construction at the Heathwall Pumping Station site is assumed to start in 2017 and be complete by 2020.

17.2.4 A shaft approximately 46 metres deep with an internal diameter of approximately 16 metres would be constructed on the land at Middle Wharf to the east of the pumping station.

17.2.5 A temporary construction area of reclaimed land, called a cofferdam, would be constructed to enable a work site to be established and to enable the construction of the shaft and other structures. The cofferdam would be retained by steel piles or similar and built up to ensure that the site and surrounding area stay protected from flooding. The cofferdam would be filled up to existing ground level so that the site is directly accessible to vehicles from the pumping station.

17.2.6 Material used to fill in the cofferdam, and also excavated material arising from construction of the shaft would be transported by barges, minimising the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

17.2.7 Barges would moor on the southern side of the cofferdam, whereby they would sit upon a concrete bed or ‘campshed’ during periods of low tide. The average peak daily number of barges would be two.

17.2.8 During construction vehicles would access the site from existing access points on Nine Elms Lane. The average peak daily number of lorry trips at this site would be 18.

17.2.9 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, ensuring safety for road users and pedestrians by controlling movement of vehicles, and limiting barge loading/unloading to daytime only to reduce noise at neighbouring residential properties.

17.2.10 The plan below (Figure 17.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

17.2.11 To help explain this information, the schematic diagram below (Figure 17.5) illustrates where the structures may be located within these zones.

17.2.12 The permanent structure in the river would create a new area of public space. Together with a new publically accessible footway in front of Middle Wharf, it would enable the Thames Path to be connected along the riverside, closing one of the last few gaps in the riverside walkway on the south side of the River Thames between Battersea and Southwark Bridge. Because Middle Wharf is designated as a 'safeguarded wharf', the design includes gates that can close off the path when it is needed for use by the wharf, or when Thames Water needs access to carry out maintenance. During these times, pedestrians would be diverted back to the existing route of the Thames Path, along Nine Elms Lane.

17.2.13 While most of the structures would be underground, two 4 to 8 metre high ventilation columns would be located near to the shaft to provide ventilation of the shaft and the connection to one of the sewers. In addition, a smaller diameter 6 metre high ventilation column would be located to the west of the pumping station to provide ventilation of the connection to the second sewer.

17.2.14 The height of the new ventilation columns, in combination with filters included in the below-ground structures, would control odour and minimise any effect on surrounding residents. These above-ground structures are illustrated in Figure 17.6.

17.2.15 Below-ground equipment would be controlled by electrical and control equipment located within the existing pumping station building. Two small local push-button control pillars would be located outside of the building to allow Thames Water to safely operate below-ground equipment.

17.2.16 Operational lighting of the riverside walkway and permanent structure in the river would be minimal and designed to avoid light pollution, whilst providing safe access.

17.2.17 Once operational, routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Access to the site would be from the existing access to Heathwall Pumping Station.

Figure 17.4 Proposed development at the Heathwall Pumping Station site

Figure 17.5 Schematic layout at the Heathwall Pumping Station site

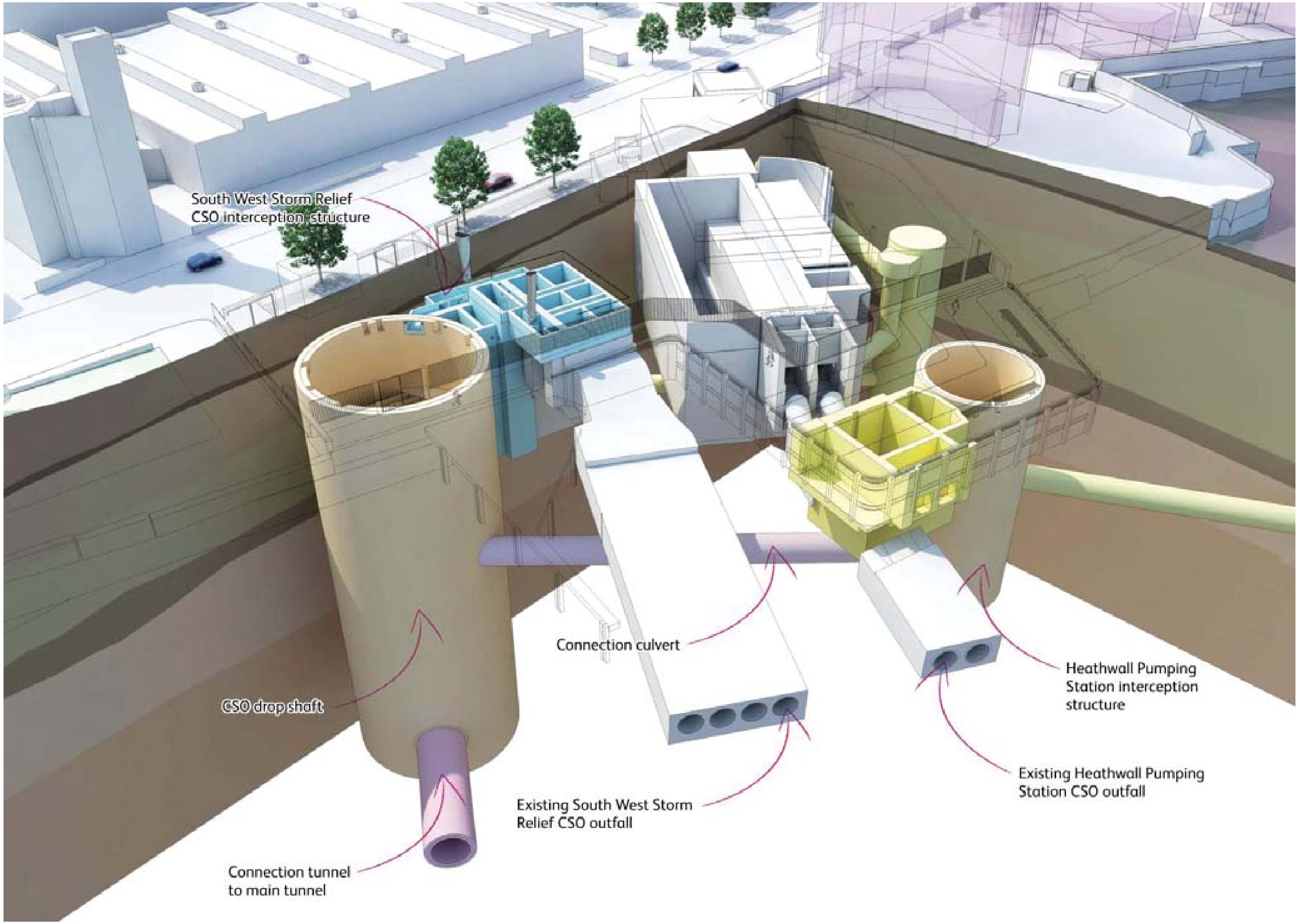
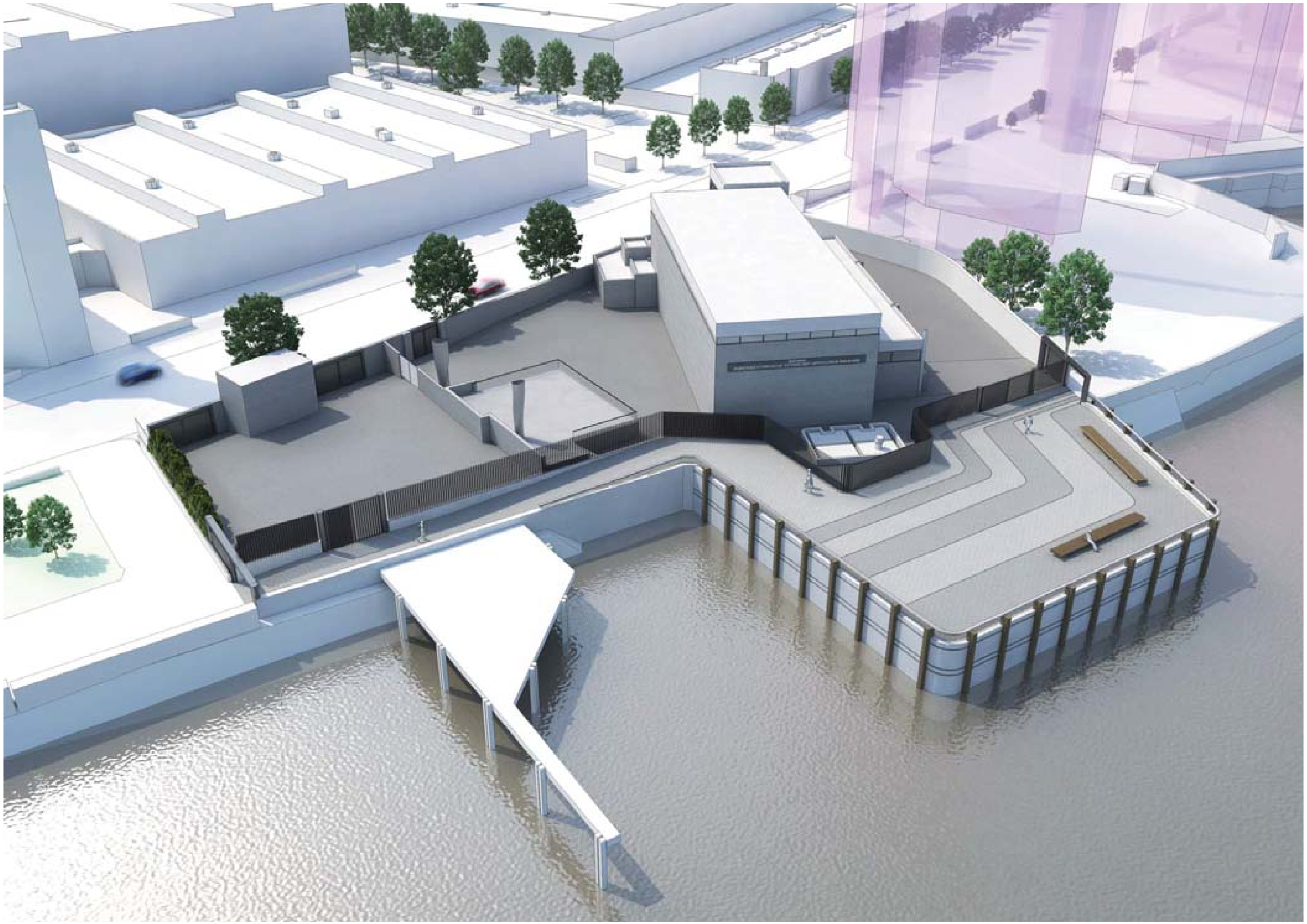


Figure 17.6 Heathwall Pumping Station site – illustrative aerial view



17.3 Effects of the proposed development at Heathwall Pumping Station on the environment

Introduction

17.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

17.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in the Section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

17.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Heathwall Pumping Station site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 15 of the *Environmental Statement*.

Effects during construction

17.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tug boats (for river barges) that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and people who use the adjacent Thames Path for recreation. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on local residents, those using the area around the site for recreation or businesses such as the offices on Nine Elms Lane. This is due to the small increase in pollutant concentrations predicted.

17.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. Controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

17.3.6 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. In terms of noise effects from construction works on site, the presence of control measures such as noise screens on the edge of the cofferdam would help reduce noise at some receptors. However, there would be significant adverse effects on one block of the Riverlight development due to the construction works. No significant noise effects from construction traffic (either road-based or river-based) are expected given the small predicted changes in traffic noise levels.

17.3.7 It is not possible to further reduce the noise effects through on site controls. However, the residents of the Riverlight development that would be affected by noise may be eligible to apply for noise insulation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*, which if accepted, would reduce the effects to not significant.

17.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

17.3.9 In terms of townscape, significant adverse effects on the areas around the Heathwall Pumping Station site are predicted. This is due to the change to the setting of the areas from the introduction of construction activity including related activities at the adjacent Kirtling Street site.

17.3.10 There would also be significant adverse effects on a number of viewpoints. This is largely down to the visibility of the site and the presence of construction equipment including the cofferdam at the Heathwall Pumping Station site and the river jetty at the Kirtling Street site.

17.3.11 Consideration of the amenity of local residents and other local land uses including the nearby Thames Path and businesses such as the Battersea Barge bar and restaurant is provided in the assessment of socio-economics. This takes into account the noise, vibration, air quality, construction dust and visual effects on local amenity. No significant effects are predicted on the amenity of Thames Path users or local residents. The Battersea Barge would have to be temporarily relocated a short distance from its current location to allow the cofferdam to be built.

No significant socio-economic effects are anticipated as a result of the relocation. This is because compensation would be available to the business under the *Thames Tideway Tunnel Compensation Programme*. In addition, no significant noise, vibration, air quality or visual effects are predicted on its customers from the construction works.

17.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of river users, road users and pedestrians would ensure that no significant transport effects would occur.

17.3.13 A study of historical maps, previous archaeological records and research into local history have been undertaken to build up a picture of the possible below ground remains. Construction work on site would involve changes to both above ground features as well as the environment below ground.

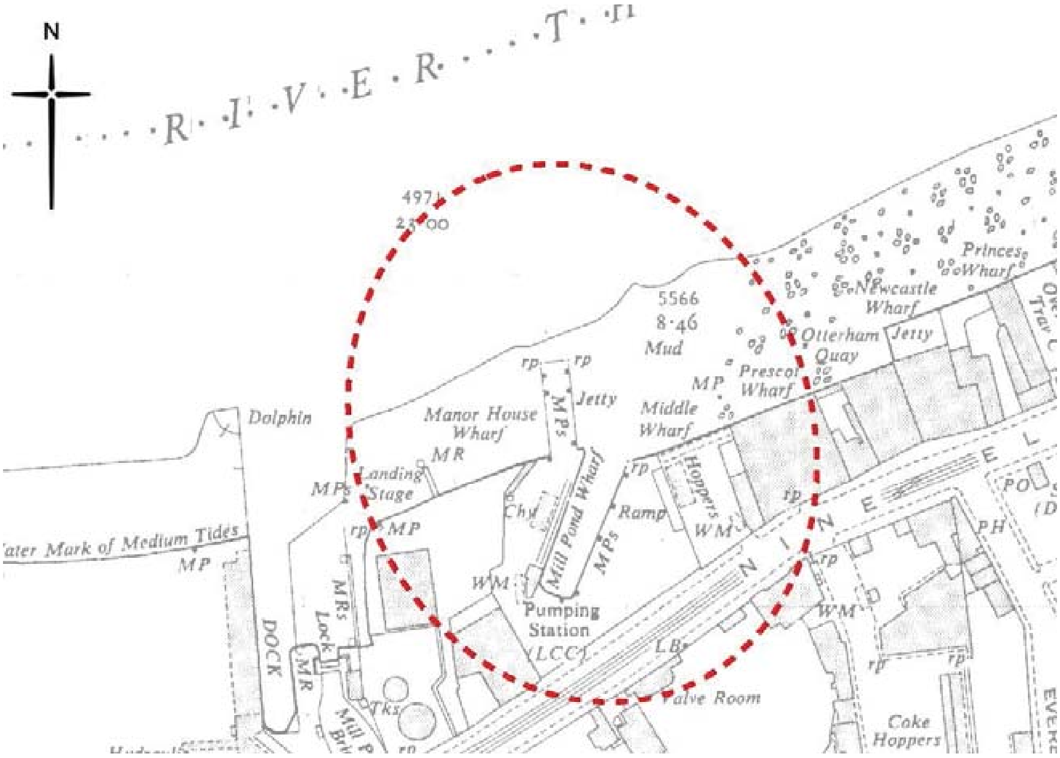
17.3.14 Information gathering has revealed that there is potential for Saxon and 18th and 19th century archaeological remains being present. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

17.3.15 The above ground features identified within and adjacent to the site include a river wall, a small public garden and the Grade II* Listed Battersea Power Station (Figure 17.7). There would only be small changes to the setting of these features and as such, there would be no significant effects on above ground historical features.

Figure 17.7 Structures in the foreshore including Middle Wharf jetty and river wall with Battersea Power Station in the background

17.3.16 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination (Figure 17.8). This may in turn affect construction workers and adjacent premises. Contaminative land uses are known to have taken place on and around the site these include a whiting and lime works and dock as well as the current use of the site as a sewage pumping station. No significant effects have however been identified. This is because workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

Figure 17.8 OS 25"mile map of 1947 (not to scale)



17.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created, resulting in pollution. At the Heathwall Pumping Station site, measures such as bunded fuel stores to reduce the risk of spills and treatment of water from excavations would be implemented to ensure there would be no significant effects on groundwater quality.

17.3.18 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. At the Heathwall Pumping Station site a route for pollutants to enter the water may arise during the construction of the temporary cofferdam within the River Thames. This is because pollutants could be disturbed by excavation in the foreshore. Another route for pollutants could be from substances used in construction (for example, oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants getting into the river in this way. Pollutants would either go into existing drains or be collected on site in tanks that would allow the pollutants to separate from the water before it is released into drains. Based on the application of these measures, no significant effects on surface water would occur.

17.3.19 The construction of the cofferdam in the foreshore of the River Thames at this location would lead to some changes in the flow of water in the river, which may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with appropriate protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

17.3.20 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, fluvial, surface water and sewer flooding at the site. The proposed development could change the level of risk associated with all sources of flooding. However, the cofferdam would be constructed in the foreshore to the same height as the existing flood defence. Based on the assessment, there would be no change in flood risk as a result of construction works.

17.3.21 The River Thames provides an important habitat for river ecology. The construction of the cofferdam would mean that some of the river habitat would be lost. However, the total temporary landtake from habitats within the river from construction of the cofferdam and the campshed would be a small percentage of the total area of the River Thames and its tributaries, which are designated for their nature conservation value. As such, no significant effects due to landtake are likely. There is also likely to be some disturbance of habitats and species due to barge movements but as this would be over a limited area, effects would not be significant.

17.3.22 The presence of the cofferdam in the river would lead to some changes in the flow of water in the river. This could affect the speed of flow and consequently could change the area over which sediments are deposited. Such localised changes are not predicted to result in any significant effects on aquatic ecology.

17.3.23 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including noise screening and avoiding direct lighting of the river. No significant adverse effects are therefore predicted.

17.3.24 The River Thames also provides habitat for wintering birds and bats. The existing inland section of the Heathwall Pumping Station site of limited value to land based ecology. The site consists primarily of buildings and paved areas (Figure 17.9). As such the clearance of shrubs and the existing buildings on site would not have significant effects on land based ecology. Habitat would be reinstated on site after completion of the works and new trees would be planted adjacent to the site on Nine Elms Lane. There would therefore be no likely significant adverse effects on land based ecology.

Figure 17.9 Middle Wharf (former concrete batching plant compound)

17.3.25 The assessments have considered other developments that are planned nearby during the same timeframe that would interact with the construction work at the Heathwall Pumping Station site. Significant adverse cumulative visual effects have been identified from other nearby developments. Significant adverse cumulative amenity effects have also been identified on the Battersea Barge, residential receptors near the site and users of the Thames Path. No other likely significant cumulative effects have been identified.

Effects during operation

17.3.26 The operational site would include a below-ground air treatment chamber connected to three new ventilation columns (two would be 4 to 8 metres and the other 6 metres in height). The ventilation structures would include filters that would remove odours from air to be released. The height of the ventilation columns would allow the elevated release of expelled air. This would ensure that there are no significant effects from odour during operation.

17.3.27 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by sound insulation. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

17.3.28 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. These maintenance visits may lead to some temporary, short-term delay to users of the local road network. However, these operational activities would not lead to significant effects.

17.3.29 No significant effects are predicted on the townscape character areas surrounding the site as features remaining on site would be well designed. There would be a significant beneficial effect on the view west from the westbound carriageway of Nine Elms Lane. This is due to the new tree planting along Nine Elms Lane obscuring views of Heathwall Pumping Station. Effects other viewpoints would be not significant.

17.3.30 The Thames Path close to the site currently does not run adjacent to the River Thames. Once construction works at the Heathwall Pumping Station site are complete, this section of the Thames Path would be rerouted along the riverfront. The extension of the river wall out into the foreshore would also provide an increased area of landscaped public amenity space. While beneficial in terms of socio-economics, this would not be a significant change.

17.3.31 Groundwater levels and quality could be affected by seepage into and out of the shaft, however the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

17.3.32 The proposed permanent structures at the Heathwall Pumping Station site have the potential to affect the movement of water within the river, and consequently deposition and erosion of sediments. However, protective measures for any affected structures would be included in the operational development. No significant adverse effects are therefore predicted.

17.3.33 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge points to which the site is connected, resulting in significant benefits to water quality.

17.3.34 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology (Figure 17.10). Sewage in the river leads to high levels of bacteria which remove oxygen from the water, leading to the death of fish. Reduced levels of sewage entering the river would mean this would happen far less often, which would therefore have a significant beneficial effect on fish populations. It is also likely that there would be significant beneficial effects from an increase in pollution sensitive fish species and an improvement in the quality of foraging habitat for fish.

17.3.35 The permanent loss of foreshore habitat would have a significant adverse effect on river habitats. To compensate for this, and other Thames

Tideway Tunnel sites where permanent works in the river are proposed, a series of compensation measures have been developed. These include schemes to improve access to or creation of habitats elsewhere along the River Thames and its tidal tributaries.

Figure 17.10 Foreshore area surveyed for river based ecology

17.3.36 The fully built project would also not alter the existing flood risk and the site would be defended by new flood defences. Therefore the operational flood risk effects would not be significant.

17.3.37 The design of the development present at the Heathwall Pumping Station site during operation could affect the setting of nearby heritage assets, namely Battersea Power Station. The operational developments at both the Heathwall Pumping Station and Kirtling Street sites would form a small part of views to Battersea Power Station from the east, south and west. However, as the developments would be in keeping with the existing industrial area, no significant effects are considered likely.

17.3.38 The assessments have considered other developments that are planned nearby that would interact with the operation of the development site. No likely significant cumulative effects have been identified.

17.3.39 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no effects in terms of contaminated land and therefore effects on this aspect of the environment have not been assessed.

c. As operational activities would be limited at this site and would not lead to likely significant operational effects on land-based ecology, this was not assessed.

17.4 Further information

17.4.1 Further information regarding the assessment of the Heathwall Pumping Station site can be found in Volume 15 of the *Environmental Statement*.

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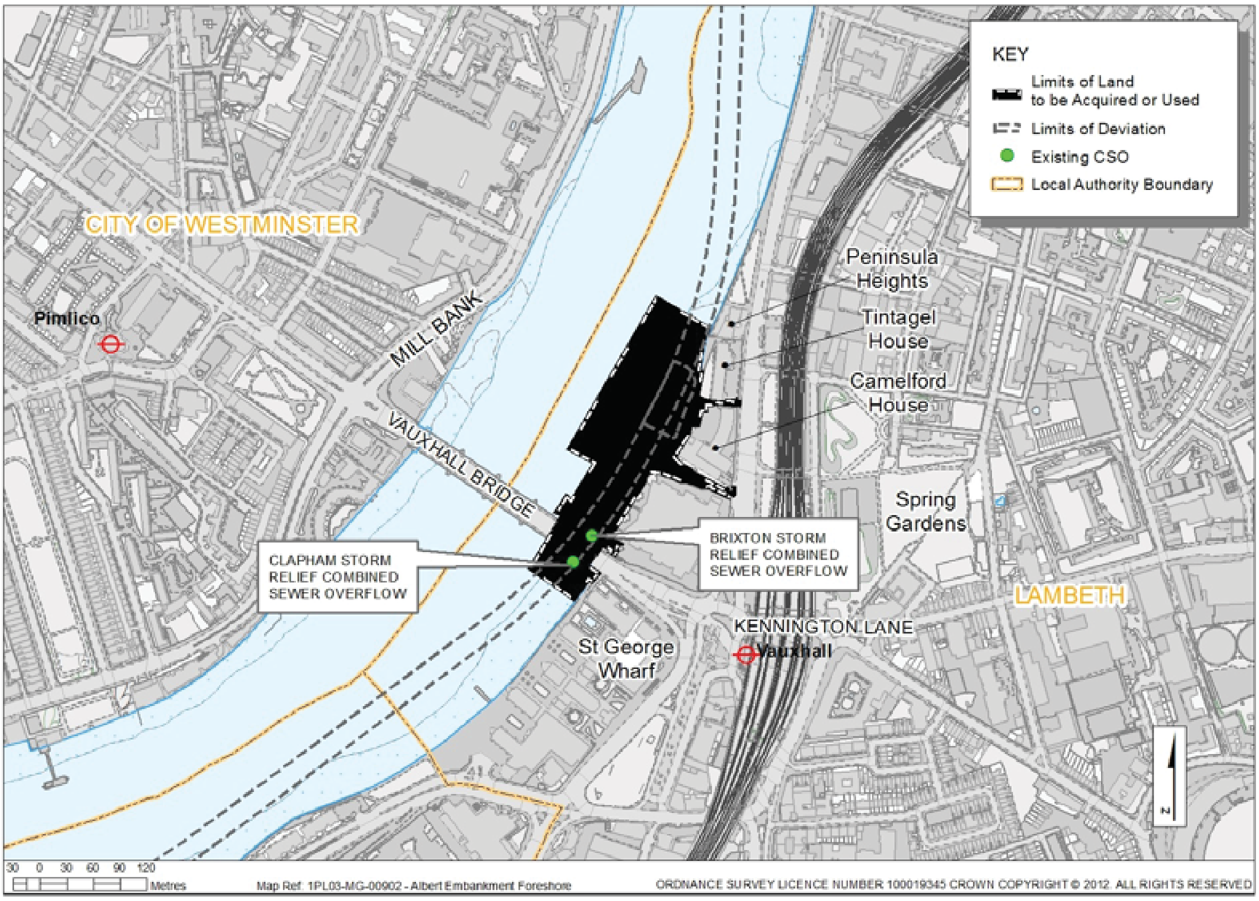
18 Albert Embankment Foreshore

18.1 Existing site context

18.1.1 The proposed development site at Albert Embankment Foreshore is located within the London Borough of Lambeth on the southern bank of the River Thames. The site comprises the River Thames foreshore under, and on both sides of Vauxhall Bridge, and extends approximately 250m north. The site also includes Lacks Dock access and slipway.

18.1.2 The site is bounded by the River Thames to the north, south and west. Three high rise office buildings (Vauxhall Cross, Camelford House and Tintagel House) plus the St George Wharf mixed-use development are located along the eastern boundary of the site.

Figure 18.1[1]Location of proposed Albert Embankment Foreshore site



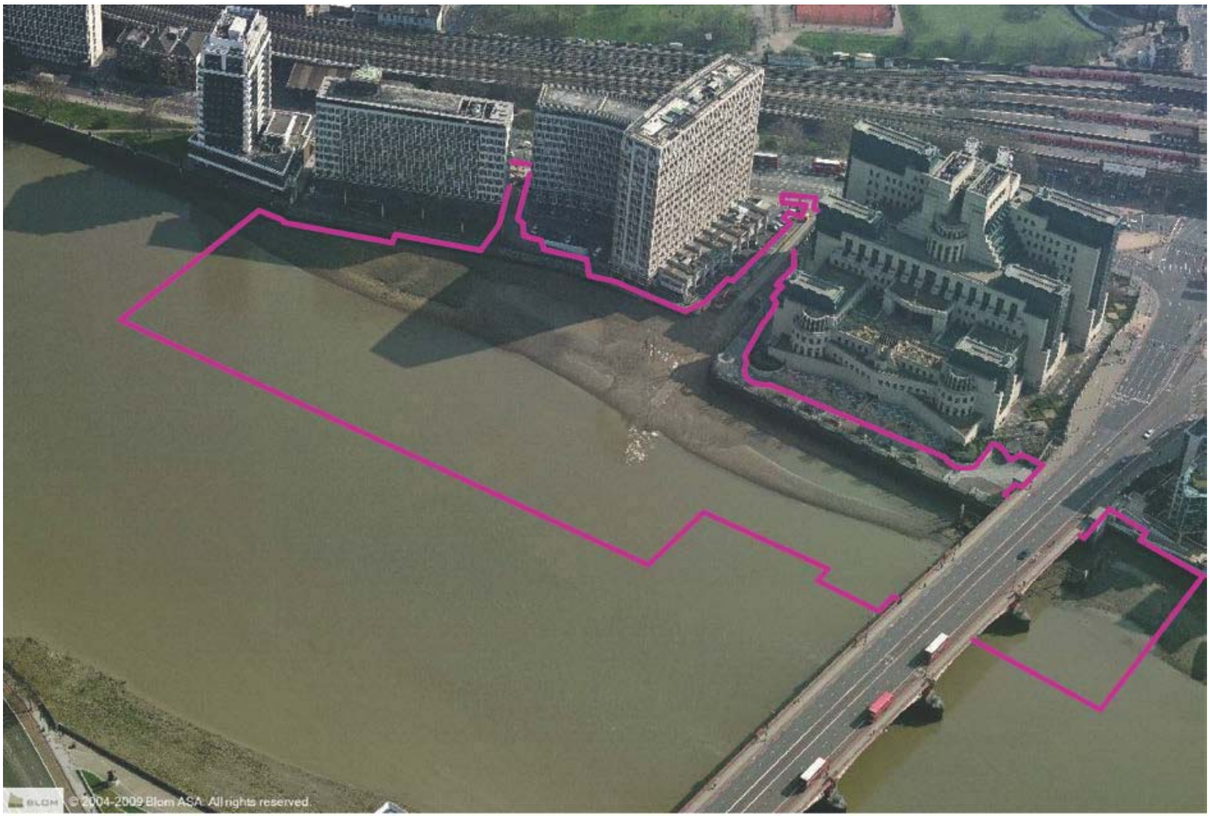
18.1.3 The surrounding area is predominantly commercial, mixed-use and residential. The nearest dwellings are Bridge House (part of the St George Wharf development), adjacent to the southeast corner of the site, and Peninsula Heights to the northeast of the site. Figure 18.1 to Figure 18.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

18.1.4 Existing site access is from Albert Embankment (A3036) which provides access to the Lacks Dock slipway and Camelford House.

18.1.5 An air quality management designation has been made by the London Borough of Lambeth covering the whole of the borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

Figure 18.2 Aerial view of existing site



18.1.6 The foreshore area of the site is within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation.

18.1.7 The southern part of the site is located beneath the Grade II* listed Vauxhall Bridge. Four Grade II listed public benches are located near the northern end of the site (immediately north of Peninsula Heights). The river wall at this location and the sturgeon lamps which sit on the wall, are also listed.

18.1.8 Additionally, the northern part of the site lies within the Albert Embankment Conservation Area, which is a designated Archaeological Priority Area. The northern part of the site also lies within the North Lambeth and Lambeth Palace Archaeological Priority Area.

18.1.9 There are no other environmental designations on or adjacent to the site.

Figure 18.3 Albert Embankment Foreshore – site context

View from river towards (left to right) Peninsula Heights, Tintagel House, Camelford House and Lacks Dock

Existing sewer discharge point adjacent to Grade II* listed Vauxhall Bridge

View from river towards Lacks Dock

Recreational tourist boat (London Duck Tours)

18.2 Proposed development

18.2.1 The purpose of this 3.1 hectare site would be to intercept two sewer overflows. One sewer overflow currently discharges untreated sewage into the River Thames on average six times each year, at a total volume of 13,000m^3. This is equivalent to approximately five Olympic sized swimming pools. The second sewer overflow currently discharges untreated sewage into the River Thames on average 29 times each year, at a total volume of 265,000m^3. This is equivalent to approximately 105 Olympic sized swimming pools. Once the existing sewers are intercepted and with flows diverted into the proposed Thames Tideway Tunnel, there would be approximately one discharge of untreated sewage in most years into the River Thames from each of these combined sewer overflows.

18.2.2 Construction at the Albert Embankment Foreshore site is assumed to start in 2017 and be complete by 2020.

18.2.3 At this site flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the main tunnel via a drop shaft.

18.2.4 The shaft would be approximately 48 metres deep with an internal diameter of approximately 16 metres and would be constructed in a new area of reclaimed land in the River Thames foreshore in front of the existing river wall in front of Camelford House.

18.2.5 Connection to the existing sewers would be made within a second new area of reclaimed land underneath Vauxhall Bridge and in front of the Vauxhall Cross building.

18.2.6 The two temporary construction areas of reclaimed land, called cofferdams, would be constructed to enable a work site to be established and to enable the construction of the shaft and connection to the existing outfalls. The cofferdams would be retained by steel piles or similar and built up to ensure that the site and surrounding area stay protected from flooding. During construction, the cofferdam underneath Vauxhall Bridge would be accessed from a ramp from the foreshore.

18.2.7 Material used to fill in the cofferdams, and also excavated material arising from construction of the shaft and other structures would be transported by barges, minimising the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported. The average peak daily number of lorry trips at this site would be 23 and the average peak daily number of barges would be four.

18.2.8 Barges would moor on the side of the cofferdams, whereby they would sit upon a concrete bed, or ‘campshed’, during periods of low tide.

18.2.9 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust and ensuring safety for road users, amphibious vehicles using Lacks Dock and pedestrians by controlling the movement of vehicles.

18.2.10 Early layouts for the site included a single construction access to the foreshore via Lacks Dock. The application for development consent however includes two options for construction access to the site. The decision maker will be asked to confirm which option should be included in the Development Consent Order.

18.2.11 Option A provides access to the site from Lacks Dock, off Albert Embankment, with construction vehicles using the northern side of Lacks Dock (currently a footpath), leaving the southern side of Lacks Dock for use by London Duck Tours, who currently use this slipway for access to and from the river in their amphibious vehicles. Construction vehicle access would be segregated from London Duck Tours access by a site hoarding, although vehicles would share the entrance onto Albert Embankment. Vehicle movements at this access point would be managed to avoid conflict.

18.2.12 Option B provides access to the site from Albert Embankment between Camelford House and Tintagel House. This would involve constructing a new vehicle access from Albert Embankment, including removal of an existing low boundary wall to Tintagel House and removal of several parking spaces. The construction access would require modification to the ramp down to the basement car park of Camelford House. Access to the basement car park would be maintained through a one-way traffic light system. Under this option, occasional access for vehicles carrying large construction plant/machinery would be the Lacks Dock slipway (as described in Option A above).

18.2.13 Under both options, all materials would first be brought to the construction site in front of Camelford House, including those required to build the connection to the existing sewers under Vauxhall Bridge. Materials would be shuttled between the two areas across the foreshore at low tide. Measures would be put in place to manage conflicting movements between these vehicles and London Duck Tours vehicles entering the river at this location.

18.2.14 The plan below (Figure 18.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

18.2.15 To help explain this information, the schematic diagram below (Figure 18.5) illustrates where the structures may be located within these zones. The permanent structure constructed in the river in front of Camelford House would create a new area of public space. This would include a new landscape design including trees and seating.

18.2.16 The permanent structure underneath Vauxhall Bridge would not be publicly accessible but it would be appropriately landscaped with planted, floodable terraces to provide biodiversity and soften its visual impact in the context of the setting of the Grade II* listed bridge. The terraces would cover over buried structures connecting to the existing outfalls.

18.2.17 While most of the structures would be underground, two 4-8 metre high ventilation columns would be located near to the shaft to provide ventilation. In addition, three smaller diameter six metre high ventilation columns would be located on the structure under Vauxhall Bridge to provide ventilation of the connections to the sewers.

18.2.18 The height of the new ventilation columns, in combination with filters included in the below-ground structures, would control odour and minimise any effect on users of the Thames Path and occupants of adjacent offices. The above ground structures are illustrated in Figure 18.6.

18.2.19 Below-ground equipment would be controlled by electrical and control equipment located within two kiosks. One kiosk would be located underneath Vauxhall Bridge and a second would be located on the new area of public realm in front of Camelford House. In addition, a small control pillar would be located on the new structure under Vauxhall Bridge to allow Thames Water to safely operate the below-ground equipment.

18.2.20 Existing lighting on the Thames Path would be reinstated for the operational phase.

18.2.21 Once operational, routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Access to the site would be from Albert Embankment via Lacks Dock.

Figure 18.4 Proposed development at the Albert Embankment Foreshore site

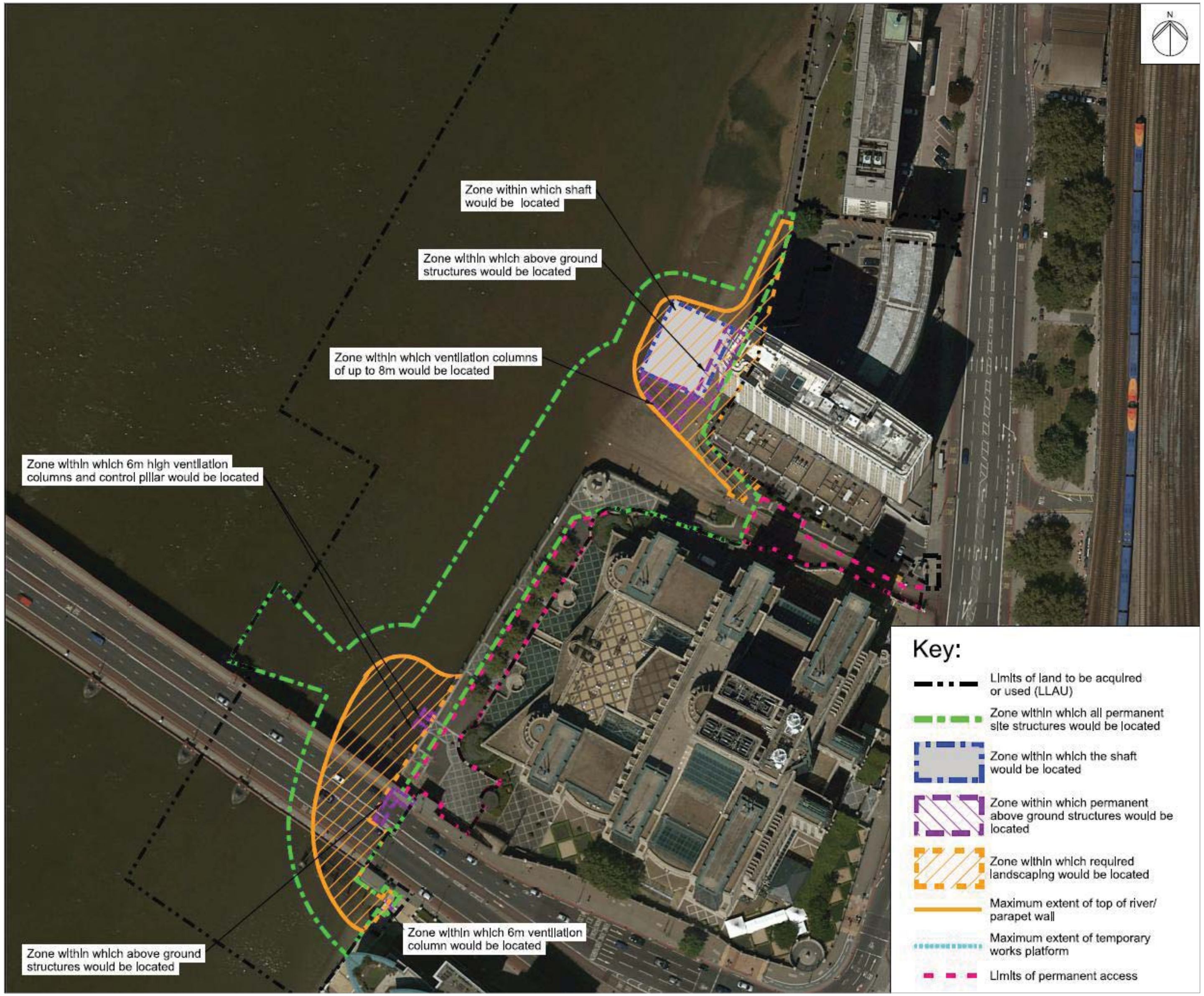


Figure 18.5 Schematic layout at the Albert Embankment Foreshore site

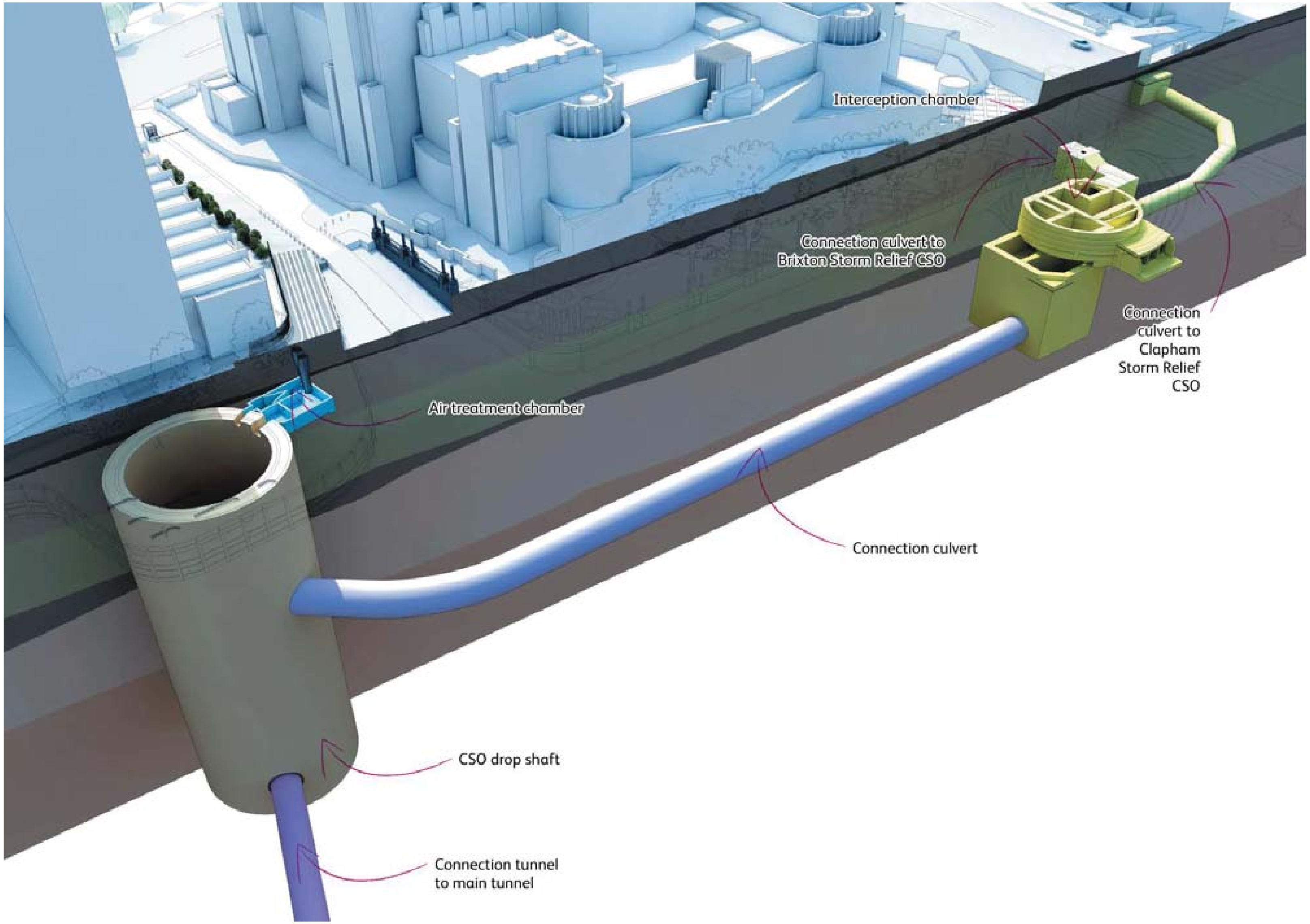


Figure 18.6 Albert Embankment Foreshore site – illustrative aerial view

18.3 Effects of the proposed development at Albert Embankment Foreshore on the environment

Introduction

18.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

18.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

18.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Albert Embankment Foreshore site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 16 of the *Environmental Statement*.

Effects during construction

18.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tug boats (for river barges) that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in significant effects on local residents, offices, those using the area around the site for recreation or other nearby receptors. This is due to the minor increase in pollutant concentrations predicted.

18.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

18.3.6 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. In terms of noise effects from construction works on site, the presence of control measures, such as site hoarding to provide acoustic screening, would help reduce noise at some receptors. Significant adverse noise effects from construction works on site are predicted on the three office buildings adjacent to the site; Camelford House, Tintagel House and Vauxhall Cross. No significant noise effects from construction traffic (either road-based or river-based) are predicted due to small changes in traffic noise levels. It is not possible to further reduce the noise effects through on site controls. However, the owners of the offices that would be affected by noise may be eligible to apply for compensation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*.

18.3.7 Vibration related to construction activity can affect nearby properties and their inhabitants. Significant adverse vibration effects have been identified at Bridge House, Camelford House and Vauxhall Cross. These vibration effects would be due to piling that would be undertaken for the cofferdam and shaft construction. It may be possible to reduce the vibration effects by using low vibration piling methods. If ground conditions at the site are such that these methods could be implemented, effects would not be significant. However, the specific ground conditions encountered would not be known until piling is underway. If ground conditions do not allow these methods to be implemented then the residents and owners of the offices that would be affected by vibration may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme*.

18.3.8 In terms of townscape, significant adverse effects on the townscape around the Albert Embankment Foreshore site are likely. This is due to construction activity including the temporary construction works (cofferdams) in the river. In addition, there would be construction activity at the nearby Thames Tideway Tunnel sites at Kirtling Street and Heathwall Pumping Station (described further in Sections 16 and 17 of this non-technical summary).

18.3.9 People using the area around the site, including residents and those using the surrounding area for recreation, may also be subject to visual effects, that is effects on their experience of views. Given the highly visible temporary cofferdams and the construction activities, there are likely to be significant adverse effects from three residential viewpoints and five recreational viewpoints including from the Thames Path.

18.3.10 Consideration of the amenity of local residents, businesses and users of the nearby Thames Path is provided in the assessment of socio-economics. This takes into account the noise, vibration, air quality, construction dust and visual effects on local amenity. Although some noise, vibration and visual effects have been identified, it is not considered likely that these would result in significant effects on amenity.

18.3.11 The socio-economic assessment has also considered the effect of the works on the operators of the Duck Tours using Lacks Dock. No significant effects have been identified on this business as the tour company would still be able to operate its services and its timetable would be unimpeded.

18.3.12 Measures proposed would minimise disruption and ensure safety of road users and pedestrians. The only significant adverse effects predicted would be on pedestrians and local residents using the Thames Path and Albert Embankment footways. These effects would arise because of the temporary footpath diversions which would be necessary to allow safe movement of construction vehicles to and from the site.

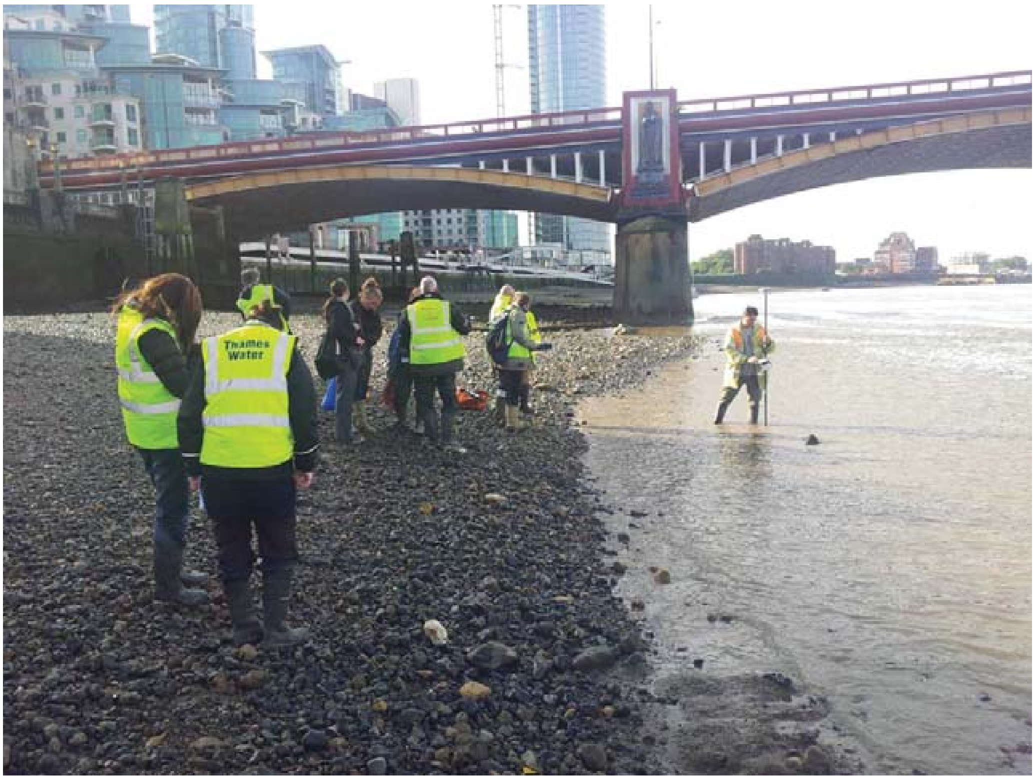
18.3.13 A study of historical maps, previous archaeological records and research into local history have been undertaken to build up a picture of the possible below ground remains (Figure 18.7). Construction works on site would involve changes to both above ground features as well as the environment below ground.

Figure 18.7 The Palace of Westminster from the Albert Embankment: 1920-1933 (Image 79172 © Museum of London)

18.3.14 Information gathering has revealed that there are known prehistoric remains, which if analysis shows to be part of a man-made structure, would be the oldest such feature in London (Figure 18.8). There is also potential for post-medieval remains. In addition a Bronze Age structure was identified upstream of the site. Given this, prior to or during construction, a programme of archaeological investigation would take place to record features of interest.

18.3.15 Above ground features of interest include the listed Vauxhall Bridge and the Vauxhall Cross building. There are significant adverse effects predicted on the Albert Embankment Conservation Area and Vauxhall Bridge due to the change to the historic character and setting caused by the construction works.

Figure 18.8 Survey of pre-historic wooden remains at Albert Embankment



18.3.16 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The majority of the site is within the foreshore, which has not been subject to contaminative past uses. The land based part of the site has previously been occupied by potentially contaminative land uses including docks, gas works and oil works. No likely significant effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

18.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the water (commonly termed a ‘pathway’) is created, resulting in the mobilisation of pollution. At the Albert Embankment Foreshore site the pressure of the groundwater could interfere with the construction of the shaft by causing the base of the shaft to move upwards. Groundwater pressure would be controlled by pumping groundwater (dewatering) from the area surrounding the shaft. A modelling exercise has shown that dewatering at the site is not predicted to result in any significant adverse groundwater resource effects. Similarly the construction technique used for the shaft would prevent the shaft acting as a pathway for contamination meaning that there would be no significant adverse effects on groundwater quality.

18.3.18 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. At the Albert Embankment Foreshore site a route for pollutants to enter the water may arise during the construction of the temporary cofferdams within the River Thames. This is because pollutants could be disturbed by excavation in the foreshore. Another route for pollutants could be from substances used in construction (for example oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants getting into the river in this way. Pollutants would either go into existing drains or be collected on site. Based on the application of these measures, no significant effects on surface water would occur.

18.3.19 The construction of the cofferdams in the foreshore of the River Thames at this location would lead to some changes in the flow of water in the river, which may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with appropriate protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

18.3.20 Flooding may occur from various sources for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at the site. The proposed development could change the level of risk associated with all sources of flooding. However, the cofferdams would be constructed in the foreshore to the same height as the existing flood defences and the flood risk assessment for this site has found that there would be no change in flood risk as a result of construction works. Therefore no significant effects are predicted in respect of flood risk.

18.3.21 The River Thames provides an important habitat for wildlife. As most of the construction works at the Albert Embankment Foreshore site would take place within the river, this may have an effect on this ecology. The temporary landtake from habitats within the river from construction of the cofferdams and the campsheds at this site would result in significant adverse effects on the river habitat.

18.3.22 As described above, the presence of the cofferdams in the river would lead to some changes in the flow of water in the river. This could affect the speed of flow and consequently could change the area over which sediments are deposited. Such localised changes are not predicted to result in significant effects on aquatic ecology (Figure 18.9).

Figure 18.9 Surveys for river based ecology

18.3.23 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including hoardings to provide acoustic screening and avoiding direct lighting of the river. No significant adverse effects are therefore predicted. These control measures would also prevent significant adverse effects on land based ecology such as wintering birds and bats, for which the River Thames provides habitat. Habitat would be reinstated on site at the end of construction, including replacement tree planting.

18.3.24 The assessment has considered other developments that are planned within the vicinity of this site during the same timeframe and which could interact with the construction work at the Albert Embankment Foreshore site. Significant adverse cumulative townscape and visual effects have been identified at some of the viewpoints and one character area from construction of two other developments namely the Battersea Power Station development and the Embassy Gardens development. No other likely significant cumulative effects have been identified in the assessments.

Effects during operation

18.3.25 The operational site would include an underground air treatment chamber connected to two new ventilation columns of between 4 to 8 metres high. There would also be a further three 6 metre high ventilation columns located on the structure under Vauxhall Bridge to provide ventilation of the connections to the sewers. The below-ground air treatment chamber would include filters that would remove any odours from the air to be released. The height of the ventilation columns would allow the elevated release of expelled air. This would ensure that there are no significant effects from odour during operation.

18.3.26 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic have been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effects from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effects. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

18.3.27 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. Space to locate the cranes may require the temporary diversion of the Thames Path. The ten yearly maintenance visits may also lead to some temporary, short-term delay to users of the local road network. However, these operational activities would not lead to significant adverse effects.

18.3.28 Significant beneficial effects on the townscape character of the site are predicted due to the creation of the new public realm and design of the above ground structures. There would also be significant beneficial effects on some of the viewpoints due to the visibility of the new public realm.

18.3.29 The above ground operational structures at this site, including the permanent structure projecting into the river, could affect the setting of nearby heritage assets and conservation areas. No significant adverse effects are however predicted as the operational works would not significantly affect the setting of these assets.

18.3.30 While groundwater levels and quality could be affected by seepage into, and out of, the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

18.3.31 The proposed permanent structures at this site have the potential to affect the movement of water within the river, and consequently deposition and erosion of sediments. However, protective measures for any affected structures would be included in the operational development. No significant adverse effects are therefore predicted.

18.3.32 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge points to which the site is connected. It would remove almost all the discharges, with approximately one discharge a year from each combined sewer overflow at this site, resulting in significant improvements to water quality.

18.3.33 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology. Sewage in the river leads to high levels of bacteria which remove oxygen from the water, leading to the death of fish. Reduced levels of sewage entering the river would mean this would happen far less often, resulting in a significant beneficial effect on fish populations. It is also likely that there would be significant beneficial effects from an increase in pollution sensitive fish species and an improvement in the quality of foraging habitat for fish.

18.3.34 The permanent loss of valuable foreshore habitat (Figure 18.10) would have a significant adverse effect on river habitats. To compensate for this, and other Thames Tideway Tunnel sites where permanent works in the river are proposed, a series of compensation measures have been developed. These include schemes to improve access to or creation of habitats elsewhere along the River Thames and its tidal tributaries.

18.3.35 The fully built project would also not alter the existing flood risk and the site would be defended by new flood defences. Therefore the operational flood risk effects would not be significant.

18.3.36 The assessments have considered other developments that are planned nearby and which could interact with the operation of the project at the site. No significant cumulative effects have been identified.

18.3.37 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no likely significant effects on land quality and therefore this has not been assessed.

c. As operational activities would be limited at this site and would not lead to significant operational effects on land-based ecology, this has not been assessed.

Figure 18.10 Extended section of river wall to the north east of the site, decorated with lion head sculptures containing mooring rings

18.4 Further information

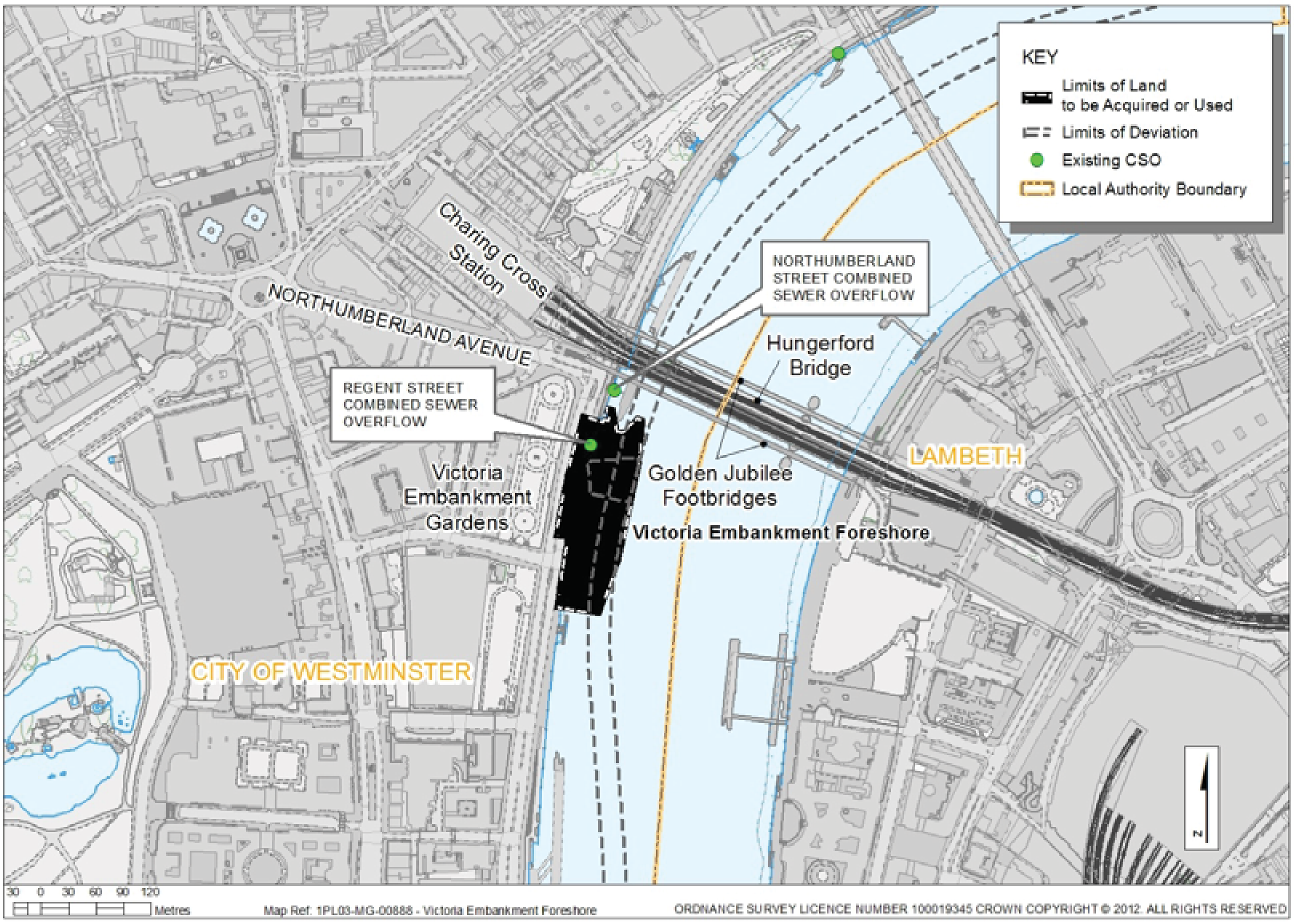
18.4.1 Further information on the assessment of the Albert Embankment Foreshore site can be found in Volume 16 of the *Environmental Statement*.

19 Victoria Embankment Foreshore

19.1 Existing site context

19.1.1 The proposed development site at Victoria Embankment Foreshore is located on the northern bank of the River Thames within the City of Westminster. The site would comprise a section of the River Thames foreshore, and a section of pavement and roadway on Victoria Embankment (A3211). The Regent Street combined sewer overflow currently discharges into the River Thames along this section of the Victoria Embankment.

Figure 19.1[1] Location of proposed Victoria Embankment Foreshore site



19.1.2 The site is bounded to the north, east and south by the River Thames and to the west by the Victoria Embankment (A3211).

19.1.3 The surrounding area is predominantly open space, commercial, and mixed-use. The nearest dwellings are at Whitehall Court to the west of the site. The Thames Path runs along the footway of Victoria

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Embankment within the boundary of the proposed site. Figure 19.1 to Figure 19.3 show the site and local context.

Figure 19.2 Aerial view of existing site

19.1.4 There is no existing vehicle access to the foreshore part of this site.

19.1.5 An air quality management designation has been made by Westminster City Council which covers the whole Borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

19.1.6 The site is predominantly located within the designated River Thames and Tidal Tributaries Site of Importance for Nature Conservation. Additionally, the Victoria Embankment Gardens: Whitehall Garden Site of Importance for Nature Conservation is located opposite the site over Victoria Embankment.

19.1.7 There are a number of Grade II listed features within the site. These include several lamp standards and decorative benches along the riverfront and the river wall itself (Figure 19.8).

19.1.8 The site lies within both the Whitehall Conservation Area, and the Lundenwic and Thorney Island Area of Special Archaeological Priority.

19.1.9 There are no other environmental designations on or adjacent to the site.

Figure 19.3 Victoria Embankment Foreshore – site context

View from river northwards to site (Tattershall Castle (blue) and Hispaniola (white))

View southwards from Horse Guards Avenue towards Victoria Embankment

Aerial view towards the site

View from site looking south across the river with Tattershall Castle vessel in the foreground

19.2 Proposed development

19.2.1 The purpose of this 1.6 hectare site would be to make a connection to a sewer (called the Low Level Sewer No 1) under the footway and carriageway of Victoria Embankment in order to control flows from the adjacent Regent Street combined sewer overflow. This currently discharges untreated sewage into the River Thames on average five times each year, at a total volume of 22,000m^3. This is equivalent to approximately ten Olympic sized swimming pools.

19.2.2 Once the existing sewer is intercepted, with flows diverted into the proposed Thames Tideway Tunnel, in most years there would be no discharge at all of untreated sewage into the River Thames from the Regent Street combined sewer overflow.

19.2.3 The connection to the Low Level Sewer No 1, as well as a connection to the Low Level Sewer No 1 at two other sites (Chelsea Embankment Foreshore and Blackfriars Bridge Foreshore), would control the flows within the wider sewer system. This would control the discharge of untreated sewage into the River Thames from ten other combined sewer overflows along the northern embankment, eliminating the need to build new drop shafts and connections to the main tunnel at these ten sites.

19.2.4 Construction at Victoria Embankment Foreshore is assumed to start in 2016 and be completed by 2021. A shaft approximately 51 metres deep with an internal diameter of approximately 13 metres would be constructed in a new area of reclaimed land in front of the existing river wall opposite Victoria Embankment Gardens, and in the approximate location of the Tattershall Castle, a floating bar and restaurant.

19.2.5 Prior to commencement of the main construction works, the Tattershall Castle would be relocated to the south of the works, to a location opposite the end of Horse Guards Avenue. This would require construction of new moorings for the vessel, including an access way up and over the listed river wall. In order to enable the relocation of Tattershall Castle, two existing service moorings would be removed. There is no access to the shore from these service moorings.

19.2.6 The temporary construction area of reclaimed land, called a cofferdam, would be constructed to enable a work site to be established and to enable the construction of the shaft and other structures. The cofferdam would be retained by steel piles or similar and built up to ensure that the site and surrounding area stay protected from flooding. The cofferdam would be filled up to existing ground level so that the site is directly accessible to vehicles from Victoria Embankment.

19.2.7 Material used to fill in the cofferdam, and also excavated material arising from construction of the shaft and other structures would be transported by barges, minimising the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

19.2.8 Barges would moor on the eastern side of the cofferdam, whereby they would sit upon a concrete bed, or 'campshed' during periods of low tide. The average peak daily number of barges would be two.

19.2.9 During construction vehicles would access the foreshore site from a new access constructed from Victoria Embankment. The average peak daily number of lorry trips at this site would be 14.

19.2.10 In order to make the connection to the Low Level Sewer No 1, existing utilities (including gas, electricity and telecommunications) would need to be temporarily diverted out of a utility subway (which sits on top of the sewer) and into the road.

19.2.11 During the diversion of the utilities, the widths of the northbound and southbound lanes on Victoria Embankment would need to be reduced in order to maintain two lanes in each direction. The existing central reservation would also be removed. Reduction to one lane southbound may be required for short durations outside of peak traffic hours. Following the utility diversions, the northbound lanes would be returned to their existing layout, but the southbound lanes would remain narrowed.

19.2.12 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, and ensuring safety for road users and pedestrians by controlling movement of vehicles.

19.2.13 The plan below (Figure 19.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

19.2.14 At an earlier design stage, a very different layout was considered which was based on a circular "island" design (for the shaft) linked to the Embankment via a curved walkway. Following stakeholder consultation, the design reverted to one presented in earlier consultations.

19.2.15 To help explain this information, the schematic diagram in Figure 19.5 below illustrates where the structures may be located within these zones.

19.2.16 The new area of land in the foreshore would provide new public realm. It would be an area in which people would be able to take in views towards the Houses of Parliament. A series of steps and ramps would provide opportunities to sit and rest. A lowered area at the front of the structure would occasionally flood to a shallow depth, and is designed to reduce the visual impact of the structure, particularly when viewed from Hungerford footbridge at low tide, soften the transition between the land and water and reference existing similar structures along the embankment such as Whitehall Stairs.

19.2.17 During the design process, several different shapes were considered for the structure in the foreshore in order to minimise the visual impact of the structure, particularly given the historic location, whilst at the same time meeting the engineering need to connect the below-ground structures from the existing sewer to the main Thames Tideway Tunnel.

19.2.18 The final design combines elements of the two earlier designs. It is almost symmetrical, with a longer connection to the river wall, but does not extend as far out into the river as either of the earlier designs. The symmetrical nature of the structure is more in keeping with other similar structures nearby, such as Cleopatra's Needle. It also reduces the potential for navigational hazards because it does not extend as far into the river.

19.2.19 While most of the structures would be underground, two four to eight metre high ventilation columns would be located on the new structure in the foreshore to provide ventilation of the shaft. In addition, a smaller diameter six metre high ventilation column would be located on the footway of Victoria Embankment to provide ventilation of the structures connecting to the sewer.

19.2.20 The height of the new ventilation columns, in combination with filters included in the below-ground structures, would control odour and minimise any effect on users of the Thames Path. These are shown in an illustrative above-ground plan in Figure 19.6.

19.2.21 Below-ground equipment would be controlled by electrical and control equipment located within two kiosks, which would be located on the line of the existing river wall. These would form part of a series of four structures along this line, providing a separation of the new area of reclaimed land from the existing embankment. The other structures may be used by others, for example as commercial kiosks. A planted pergola would connect the four structures providing shade.

19.2.22 Following completion of the main construction works, the Tattershall Castle would be moved further north, to minimise any obstruction of views along Horse Guards Avenue. One of the service moorings would be reinstated after Tattershall Castle is moved.

19.2.23 Lighting on Victoria Embankment would be reinstated as far as possible, and any new operational lighting of the foreshore structure would be designed to avoid light pollution and respect the historic environment.

19.2.24 Once operational, routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Access to the site would be from a new permanent access from Victoria Embankment.

Figure 19.4 Proposed development at the Victoria Embankment Foreshore site

Figure 19.5 Schematic layout at the Victoria Embankment Foreshore site

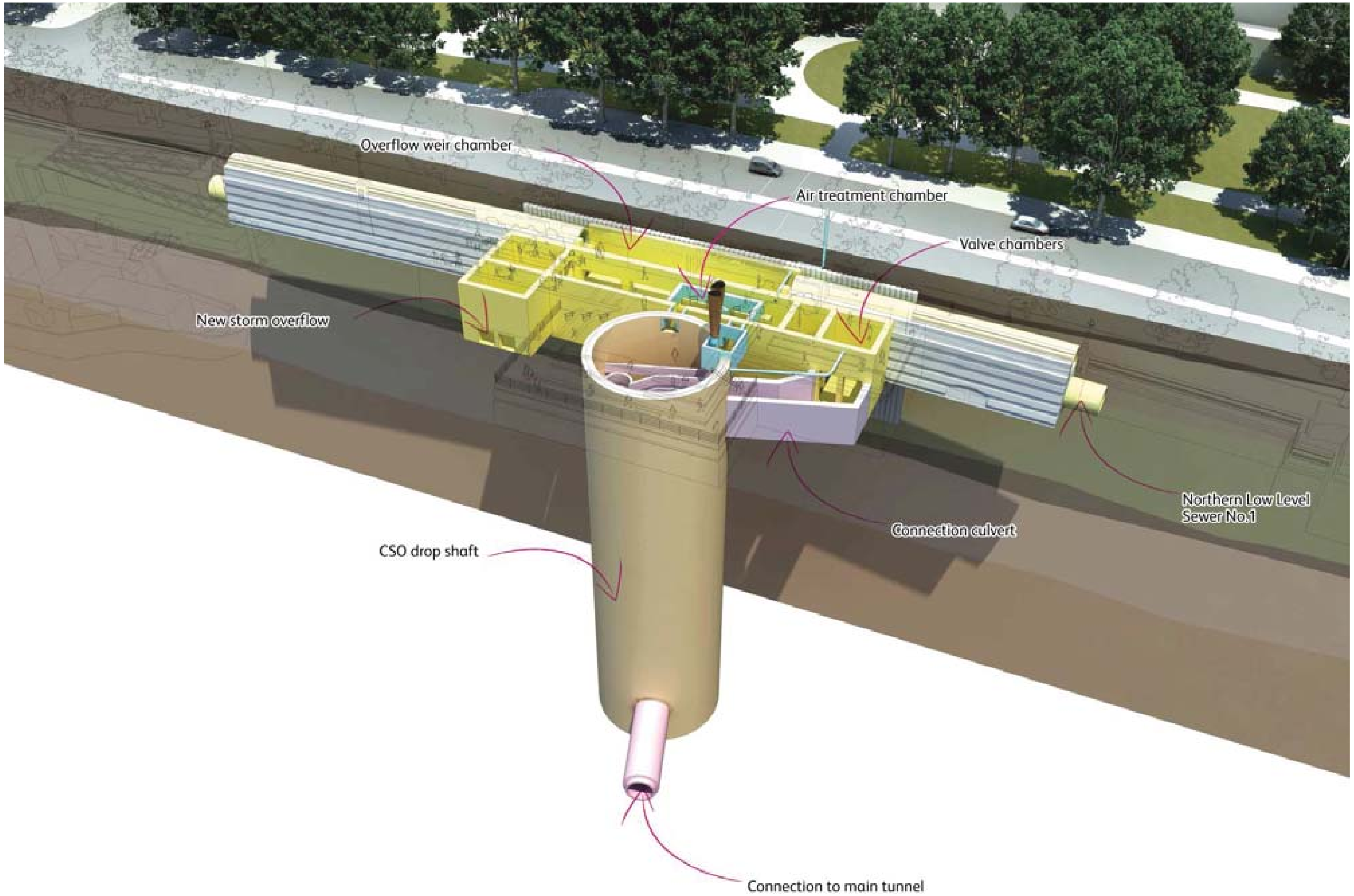


Figure 19.6 Victoria Embankment Foreshore site – illustrative aerial view

19.3 Effects of the proposed development at Victoria Embankment Foreshore on the environment

Introduction

19.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

19.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposal on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

19.3.3 The following section summarises the site effects (both beneficial and adverse) arising from the proposed development at the Victoria Embankment Foreshore site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 17 of the *Environmental Statement*.

Effects during construction

19.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tug boats (for river barges) that are used to move materials and equipment for the project. This could affect local residents, other nearby sensitive properties and users of recreational spaces such as the Thames Path and Victoria Embankment Gardens.

19.3.5 Based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on local residents or those using the area around the site for recreation. This is due to the minor increase in pollutant concentrations predicted. One exception to this is that the Tattershall Castle floating bar/restaurant would experience significant beneficial effects due to lower levels of background air pollution at its proposed new mooring location.

19.3.6 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

19.3.7 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site. In terms of noise effects from construction works on site, the presence of control measures, such as a noise barrier at each end of the cofferdam would help reduce noise at some receptors. With these measures in place, noise at most locations would not be significant. However significant adverse noise effects from construction works are predicted at two floating bar/restaurants on the River Thames: the Tattershall Castle in its temporary location, and the Hispaniola ship. No significant noise effects from construction traffic (either road-based or river-based) are expected given the small predicted changes in traffic noise levels.

19.3.8 It is not possible to further reduce the noise effects through on site controls. However, the owners of the bar/restaurants that would be affected by noise may be eligible to apply for compensation through the *Thames Tideway Tunnel Noise insulation and temporary re-housing policy*.

19.3.9 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

19.3.10 In terms of townscape, significant adverse effects in and around the Victoria Embankment Foreshore site are likely. This is due to the clearance required to form the construction site, the formation of the temporary construction works in the river (cofferdam) and the level of activity during construction.

19.3.11 People using the area around the site, including those involved in recreation, may also be subject to visual effects, that is effects on their experience of views. Significant adverse effects are predicted for a number of recreational viewpoints due to the visibility into the site and the presence of construction plant. Recreational viewpoints with significant adverse effects would be within the immediate surrounds of the site including from the Thames Path, and on the opposite bank of the river, including from the riverside outside County Hall. Further away from the site and location of the works, effects would not be significant. For example, the effect on the view from Victoria Embankment Gardens, with only partial views of tall construction cranes obscured by vegetation, is not likely to be significant.

19.3.12 Consideration of the amenity of residents and open space and Thames Path users is provided in the assessment of socio-economics, as is the effect of construction activity on the floating bar/restaurants and other businesses. This takes into account noise, vibration, air quality, construction dust and visual effects. No significant effects on amenity are predicted, with the exception of effects on the floating bar/restaurant businesses, which would arise due to noise and visual effects. The socio-economic assessment has also considered effects due to displacement of businesses and moorings, and effects on tourism, which is important in the area of this site. However, no likely significant effects have been identified.

19.3.13 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that significant transport effects are minimised. However, significant adverse effects are predicted on pedestrians passing the site, due to loss of footway, diversions and increased journey times. Coaches and service vehicles using parking facilities and loading bays on Victoria Embankment (Figure 19.7) would also experience significant adverse effects due to the relocation of coach parking and the restriction of a loading bay.

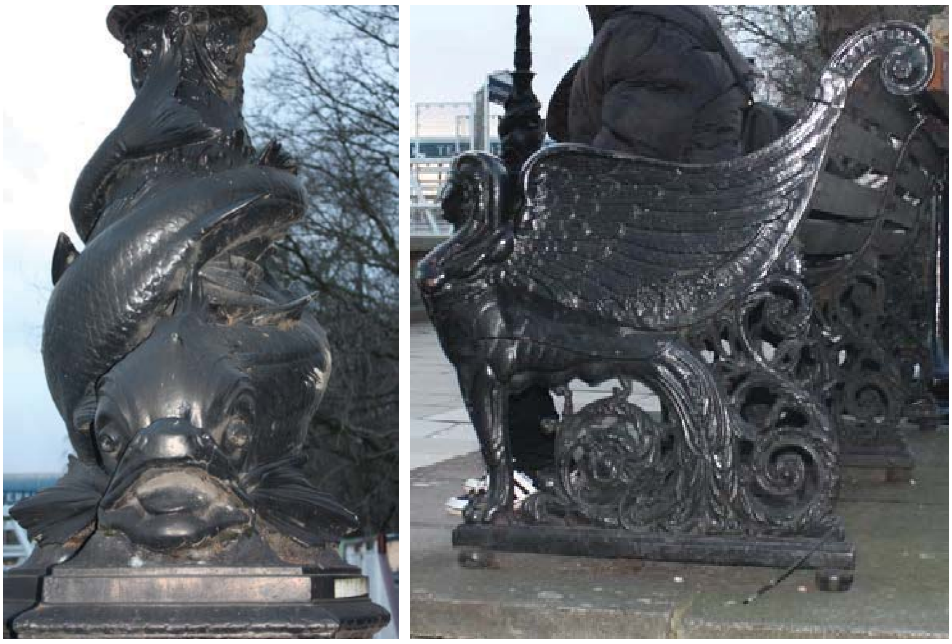
Figure 19.7 View west along Victoria Embankment with coach parking

19.3.14 A study of historical maps, previous archaeological records and research into local history has been undertaken to build up a picture of the possible below ground remains. Construction work on site would involve changes to both above ground features as well as the environment below ground. Both of these changes have the potential to affect historic assets.

19.3.15 Information gathering has revealed that there is high potential for 19th century finds associated with construction of Victoria Embankment. There is little potential for other remains, because the river channel here has been dredged in the past. Given the potential for 19th century finds, archaeologists would be present on site to observe construction and record any features of interest. Taking this into account, there would be no significant effect on features and items below ground.

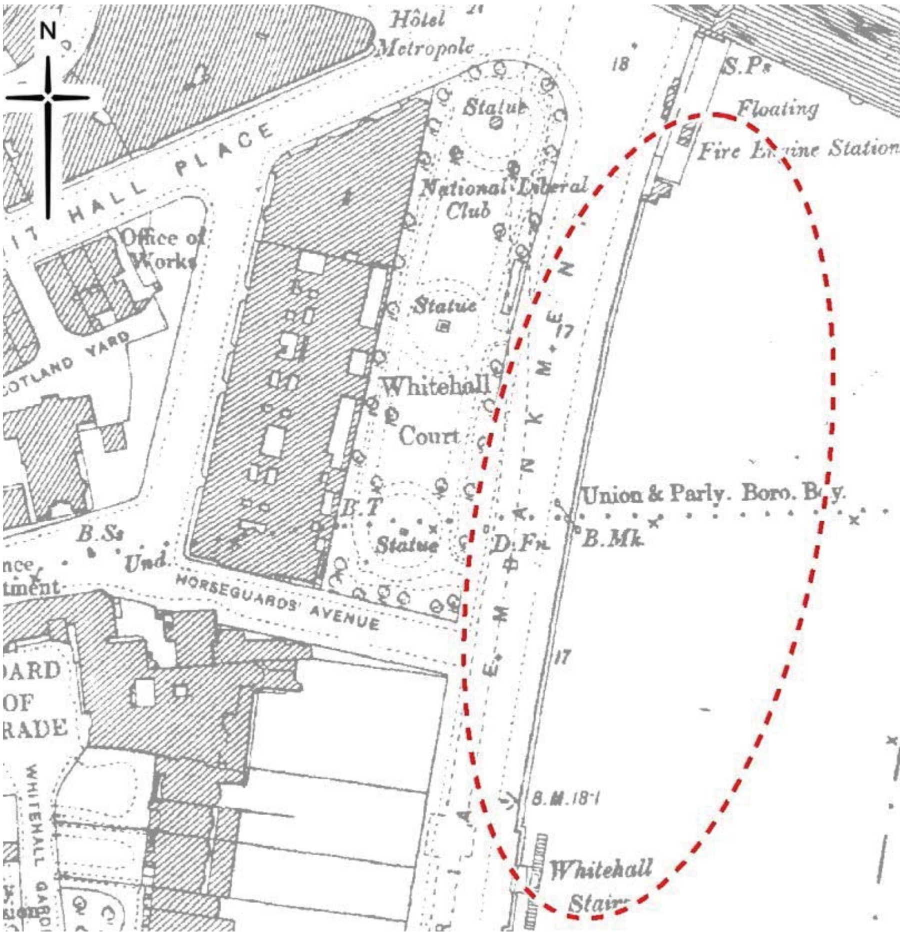
19.3.16 Part of the stone parapet of the listed river wall would be removed at an early stage of the construction process and although it would be documented before removal, the effect would still be significant adverse. Several other historic features would also be removed, such as lamps and benches (Figure 19.8), and in most cases reinstated at the end of construction. These features would be documented before removal, and no significant effects would occur. Significant adverse effects are also predicted due to the change to historic setting of several historic features caused by the construction works. For example, the listed Embankment river wall and associated heritage assets such as decorative benches and lamps, and Whitehall Conservation Area.

Figure 19.8 Detail of decorative street lamp and bench on Victoria Embankment



19.3.17 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination (Figure 19.9). This may in turn affect construction workers and adjacent premises. The site and near site area has not been subject to any major contaminative past land uses. No contaminating uses have been identified within or around the site. Nevertheless workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

Figure 19.9 Ordnance Survey 2nd edition 25”:mile map of 1896–8 (not to scale)



19.3.18 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the water (commonly termed a ‘pathway’) is created, resulting in the mobilisation of pollution. At this site the below ground structures would be at a depth where groundwater would be present. The pressure of the groundwater could interfere with the construction of the shaft by causing the base of the shaft to move upwards. To prevent this happening and to keep the below ground structures dry, groundwater would be pumped out of the structures and the below ground area where construction would take place (a process known as ‘dewatering’). A number of control measures would be applied to reduce dewatering effects; this includes limiting the amount of dewatering and stabilising the ground to remove the pathway. Given the application of these measures, no significant effects on groundwater resources or quality would occur.

19.3.19 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. At this site a route for pollutants to enter the water may arise during the construction of the temporary cofferdam within the River Thames. This is because pollutants could be disturbed by excavation in the foreshore. Another route for pollutants could be from substances used in construction (for example oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants getting into the river in this way. Pollutants would either go into existing drains or be collected on site. Based on the application of these measures, no significant effects on surface water would occur.

19.3.20 The construction of temporary construction works (cofferdam) in the foreshore of the River Thames at this location would lead to some changes in the flow of water in the river, which may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with appropriate protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

19.3.21 Flooding may occur from various sources for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, fluvial, surface water and sewer flooding at the site. The proposed development could change the level of risk associated with all sources of flooding. However the cofferdam would be constructed in the foreshore to the same height as the existing flood defence. Based on the assessment, no significant effects are predicted in respect of flood risk as a result of the construction works.

19.3.22 The River Thames provides an important habitat for river ecology. As most of the construction works at Victoria Embankment Foreshore site would take place within the river, this may have an effect on its ecology. The total temporary landtake from habitats within the river from construction of the cofferdam would be a small percentage of the total area of the River Thames and its tributaries, which are designated for their nature conservation value. As such, no significant effects due to landtake are predicted on river habitats and associated species of plants and animals. There is also likely to be some disturbance of habitats and species due to barge movements but as this would be over a limited area, no significant effects are predicted. As described in paragraph 19.3.20, while there are likely to be localised changes in the flow of water in the river, the limited extent of this is not predicted to result in significant effects on river based ecology.

19.3.23 As noted above, the presence of the cofferdam in the river would lead to some changes in the flow of water in the river. This could affect the speed of flow and consequently could change the area over which sediments are deposited. Such localised changes are not predicted to result in any significant effects on aquatic ecology.

19.3.24 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including noise screening and avoiding direct lighting of the river. No significant adverse effects are therefore predicted.

19.3.25 Construction effects for land based ecology at this site have not been assessed on the basis that there are no notable species or habitats known to be present, or the potential for them to be present, on or adjacent to the site.

19.3.26 The assessments have considered other developments that are planned nearby during the same timeframe and which could interact with the construction work at the Victoria Embankment Foreshore site. No likely significant cumulative effects have been identified.

Effects during operation

19.3.27 The operational site would include ventilation columns: two four to eight metre high ventilation columns located on the new structure in the foreshore and a six metre high ventilation column located on the footway of Victoria Embankment. Air treatment filters would also be installed to remove odour prior to release from the ventilation columns. The height of the ventilation columns would allow the elevated release of expelled air and therefore there would be no significant effect from odour.

19.3.28 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. Any noise generated by ventilation and other plant equipment would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

19.3.29 Maintenance and routine inspections of the operational infrastructure would be made every three to six months, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term temporary restrictions of on-street coach parking spaces in the immediate vicinity of the site to allow safe access to the site. This relatively minor operational activity would not lead to significant effects.

19.3.30 There would be a permanent change to the townscape character of the site and surrounding area through the introduction of a new structure projecting into the river (Figure 19.10). Through high quality design in keeping with the wider area there would be no significant adverse effects. This is also the case with visual effects.

19.3.31 The inclusion of a well landscaped space in the operational development would lead to beneficial (although not significant) effects for users of the Thames Path.

19.3.32 The above ground operational structures at the Victoria Embankment Foreshore site could affect the setting of nearby heritage assets and conservation areas. However, given the high quality design of the operational development, the scale of the operational structures and, in some cases, the presence of intervening trees and buildings, no significant adverse effects are predicted.

19.3.33 Whilst groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this in both cases would be low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant adverse effects are therefore predicted.

19.3.34 The proposed permanent structures at the Victoria Embankment Foreshore site have the potential to affect the movement of water within the river, and consequently deposition and erosion of sediments. Through protective measures for any affected structures, no significant adverse effects are likely.

19.3.35 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected, with no discharges in a typical year, resulting in significant benefits to water quality.

19.3.36 The improvements in water quality would benefit river based ecology, although fish populations at this site are relatively limited due to habitat quality and the presence of the vertical river wall. This means that more substantial (and hence significant) improvements are not predicted. As with all sites, the loss of foreshore habitat resulting from the permanent foreshore structure in the river is a significant adverse effect. To compensate for the permanent loss of foreshore habitat at this site, and other sites where permanent works in the river are proposed, a series of compensation measures have been developed. These include schemes to improve access to or creation of habitats elsewhere along the River Thames and its tidal tributaries.

19.3.37 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

19.3.38 The assessments have considered other developments that are planned nearby that would interact with the operation of the development site. No likely significant cumulative effects have been identified.

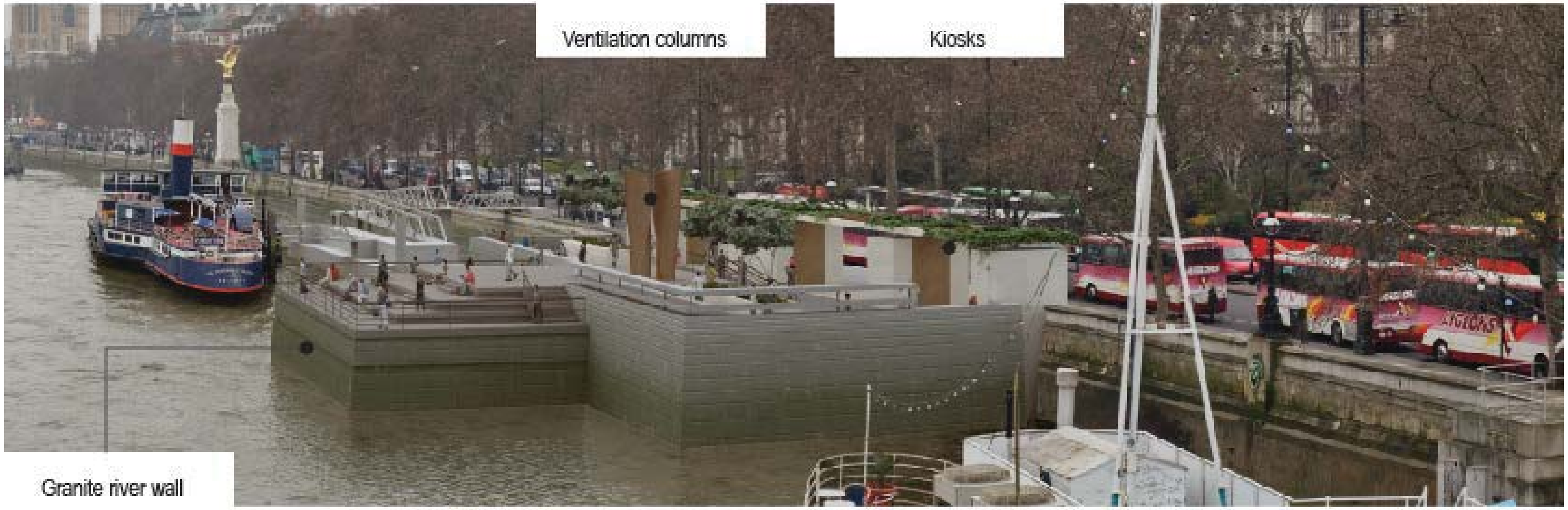
19.3.39 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. The finishing of the site with an area of hard standing would prevent any future users coming into contact with any contaminants retained below ground, and so land quality effects during operation have not been assessed.

c. As for the construction phase, given the lack of potential for land based ecology at the site, operational effects were not assessed.

Figure 19.10 Existing site and visualisation of new foreshore structure



19.4 Further information

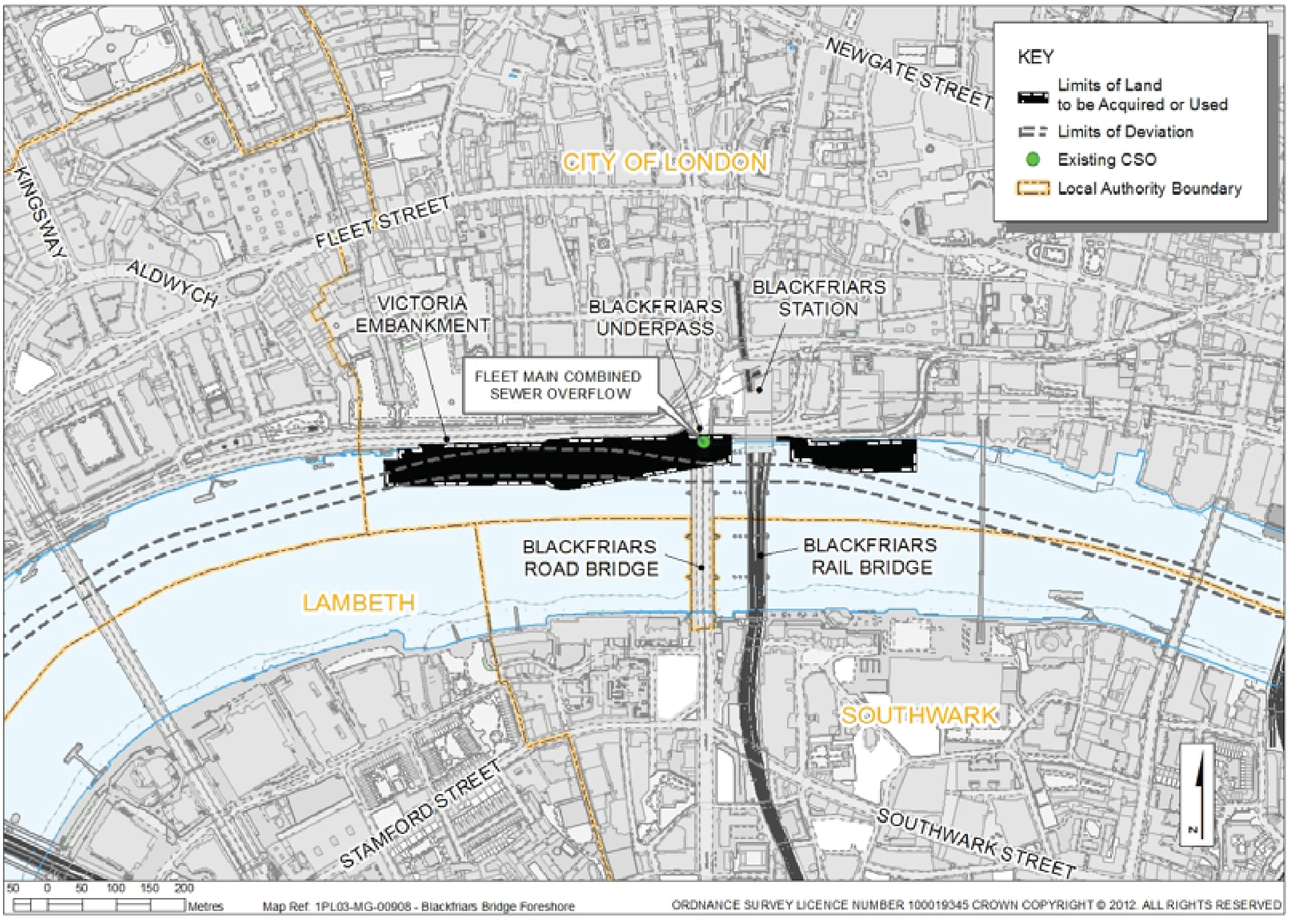
19.4.1 Further information regarding the assessment of the Victoria Embankment Foreshore site can be found in Volume 17 of the *Environmental Statement*.

20 Blackfriars Bridge Foreshore

20.1 Existing site context

20.1.1 The proposed development site is located within the City of London, close to the boundary of the City of Westminster on the northern bank of the River Thames. It comprises sections of the River Thames foreshore to the west and east of Blackfriars Bridge (A201), a section of the westbound ramp leading down from Blackfriars Bridge and areas of the pavement along Victoria Embankment (A3211) and Paul's Walk (Figure 20.1).

Figure 20.1[1] Location of proposed Blackfriars Bridge Foreshore site



20.1.2 The site comprises two parts: the main construction area, located to the west of, and under, Blackfriars Road Bridge, and a smaller secondary area (Blackfriars Pier), located to the east of Blackfriars Rail Bridge. The purpose of the secondary site is for the construction of a replacement for Blackfriars Millennium Pier which lies within the main construction site.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

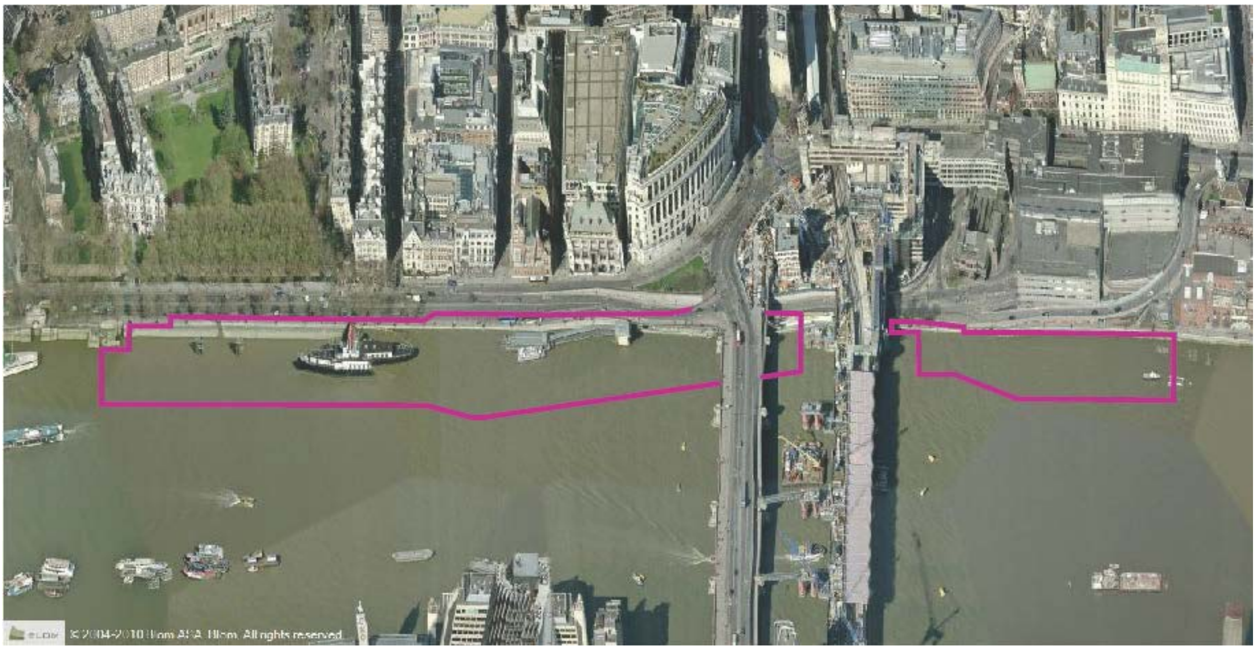
20.1.3 The site is bounded to the north by the A3211 (Victoria Embankment/ Blackfriars Underpass / Upper Thames Street), beyond which are multi-storey office buildings. It is bounded to the east, south and west by the River Thames. The site includes Blackfriars Millennium Pier, the President vessel and Chrysanthemum Pier, all to the west of Blackfriars Bridge. Figure 20.1 to Figure 20.3 shows the site and local context.

20.1.4 There is no existing vehicular access to the foreshore.

20.1.5 The City of London air quality management area includes both parts of the Blackfriars Bridge Foreshore site. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

20.1.6 The majority of the site is located within the River Thames and Tidal Tributaries Site of Importance for Nature Conservation.

Figure 20.2 Aerial view of existing site



20.1.7 Both Blackfriars Bridge and the embankment wall are Grade II listed buildings. Additionally, a number of Grade II listed buildings are located close to the site, including: Carmelite House, Sion College, the City of London School and the gate piers to the Inner Temple Garden.

20.1.8 The site lies within the Whitefriars Conservation Area and a limited part lies within the Temples Conservation Area. The site also lies within the City of London Archaeological Priority Area. It is within a protected strategic view of St Paul’s Cathedral.

20.1.9 There are no other environmental designations on or adjacent to the site.

Figure 20.3 Blackfriars Bridge Foreshore - site context

Existing view of site looking north

President vessel located within site

Existing view looking east towards Blackfriars Road Bridge

Existing view looking on eastern side of Blackfriars Rail Bridge

20.2 Proposed development

20.2.1 The purpose of this 3.9 hectare site (3.1 hectares for the main site and 0.8 hectares for the secondary site) would be to intercept a sewer which currently discharges untreated sewage into the River Thames on average 21 times each year, at a total volume of 521,000m^3. This is equivalent to approximately 210 Olympic sized swimming pools. Flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the Thames Tideway Tunnel via a drop shaft. Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, there would be approximately four discharges of untreated sewage per year into the River Thames from this combined sewer overflow.

20.2.2 During construction the site would also be used to make a connection to another major sewer (called the Low Level Sewer No 1) under the ramp between Victoria Embankment and Blackfriars Bridge. This connection, as well as a connection to the Low Level Sewer No 1 at two other Thames Tideway Tunnel sites (Chelsea Embankment Foreshore and Victoria Embankment Foreshore), would control the flows within the wider sewer system. This would control the discharge of untreated sewage into the River Thames from ten other combined sewer overflows along the northern embankment, eliminating the need for drop shafts and connections to the main tunnel at these ten sites.

20.2.3 Construction at the Blackfriars Bridge Foreshore site is assumed to start in 2016 and be complete by 2021.

20.2.4 A shaft approximately 53 metres deep with an internal diameter of approximately 24 metres would be constructed in a new area of reclaimed land in front of the existing river wall opposite Sion College, and in the approximate location of the existing Blackfriars Millennium Pier.

20.2.5 Prior to commencement of the main construction works, the President vessel (floating offices and bar) would be temporarily relocated to Chrysanthemum Pier to the west. Chrysanthemum Pier would require modification in order to accommodate the President.

20.2.6 Blackfriars Millennium Pier would be permanently relocated to the east of Blackfriars Rail Bridge. A permanent pedestrian lift would be provided to the east of Blackfriars Road Bridge to facilitate step-free access between the pier and Blackfriars Station. An existing staircase to the east of Blackfriars Road Bridge would be rebuilt to make room for the lift.

20.2.7 The temporary construction area of reclaimed land, called a cofferdam, would be constructed to enable a work site to be established and to enable the construction of the shaft and other structures. The cofferdam would be retained by steel piles or similar and built up to ensure that the site and surrounding area stay protected from flooding. The cofferdam would be filled up to existing ground level so that the site is directly accessible to vehicles from Victoria Embankment.

20.2.8 Material used to fill in the cofferdam, and also excavated material arising from construction of the shaft and other structures would be transported by barges, minimising the number of lorry trips to and from the site. Road transport would be used when river transport is unavailable or unsuitable for the material being transported.

20.2.9 During construction, vehicles would access the site from a new access constructed from the ramp from Blackfriars Bridge or from Victoria Embankment. The average peak daily number of lorry trips at this site would be 46 and the average peak daily number of barges would be three.

20.2.10 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, and ensuring safety for road users and pedestrians by controlling movement of vehicles.

20.2.11 The connection to the Low Level Sewer No 1 would be located in the ramp from Blackfriars Bridge. While this connection is constructed, the ramp would be closed to traffic and a diversion would be put in place.

20.2.12 Alternatives to closure of the ramp were considered during the design phase. The connection to the existing sewer must be located on the line of the sewer, which limits the locations that could be used. A connection to the sewer could be made on Victoria Embankment, to the west of the ramp. However this would require diversion of a significant number of major utilities (including gas mains and fibre optic cables), which would require Victoria Embankment to be narrowed down to one traffic lane in the westbound direction. Traffic modelling was carried out of these two options, and this showed that the alternative location would result in significantly more queuing and delays than the proposed solution.

20.2.13 The plan below (Figure 20.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

20.2.14 To help explain this information, the schematic diagram below (Figure 20.5) illustrates where the structures may be located within these zones.

20.2.15 The permanent area of land in the foreshore would provide new public realm, and would form part of the Thames Path. Given the size of the new foreshore structure, which is set by the engineering requirements for the below-ground structures, a small building is proposed, which could be used by others as a commercial kiosk or information kiosk. This would enhance use of the new public realm in this central London location.

20.2.16 Water features and planting have been incorporated into the design. The water features have been designed to encourage play. A flood defence wall would be built around the front of the structure, but the western end of the structure would be raised up above flood defence level to provide unobstructed views over the river and towards Westminster.

20.2.17 Lighting on Victoria Embankment would be reinstated as far as possible, and any new operational lighting of the foreshore structure would be designed to avoid light pollution and respect the historic environment.

20.2.18 While most of the structures would be underground, five 4 - 8 metre high ventilation columns would be located on the new structure in the foreshore to provide ventilation of the shaft. In addition, another 4 - 8 metre high ventilation column would be incorporated into the new wall adjacent to the ramp to ventilate the structures connecting to the outfall. A smaller diameter 6 metre high ventilation column would be located on the footway of Victoria Embankment to provide ventilation of the structures connecting to the Low Level Sewer No 1.

20.2.19 The height of the new ventilation columns, in combination with filters included in the below-ground structures, would control odour and minimise any effect on users of the Thames Path. The above ground structures are illustrated in Figure 20.6.

20.2.20 Below-ground equipment would be controlled by electrical and control equipment located within two electrical and control kiosks. One kiosk would be located at the western edge of the structure. The second would be located in the 'undercroft' area underneath the ramp.

20.2.21 Following completion of the main construction works, the President would be moved back to its existing mooring, which would be rebuilt.

20.2.22 Once operational there would be routine inspections to the site every three to six months and major maintenance work carried out every ten years. Access to the site would be from a new permanent access constructed from Victoria Embankment.

Figure 20.4 Proposed development at the Blackfriars Bridge Foreshore site

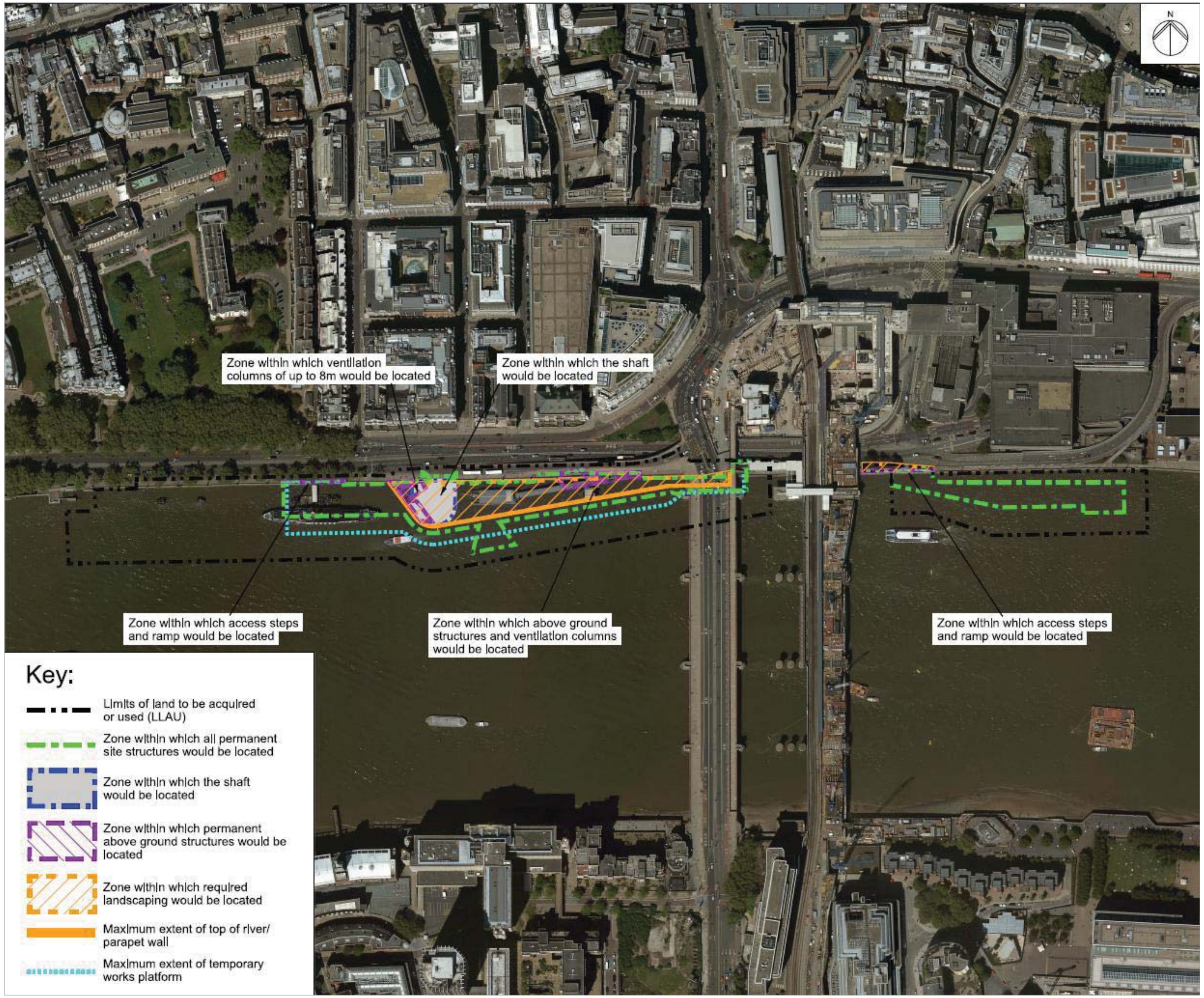


Figure 20.5 Schematic layout at the Blackfriars Bridge Foreshore site

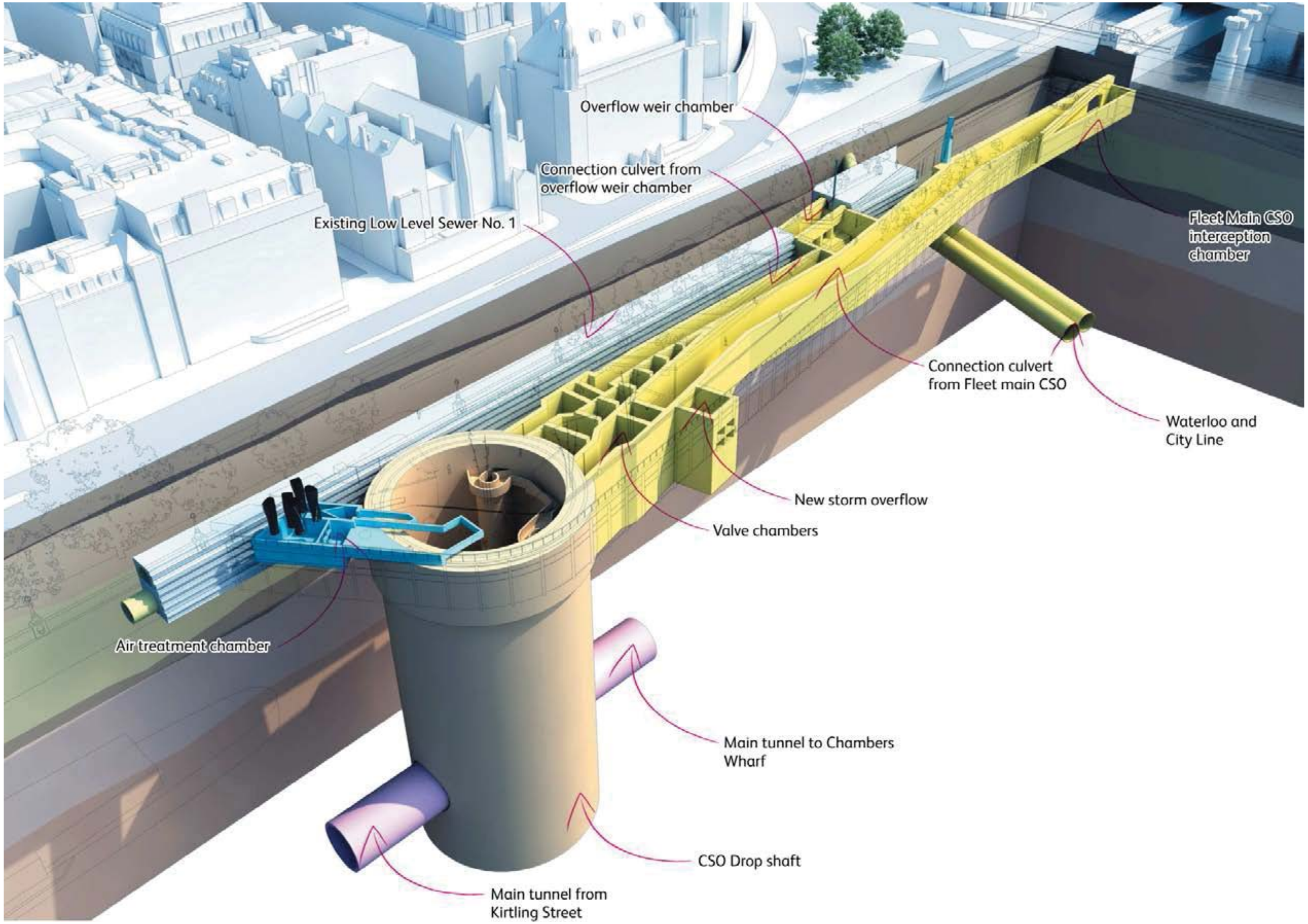


Figure 20.6 Blackfriars Bridge Foreshore site – illustrative aerial view

20.3 Effects of the proposed development at Blackfriars Bridge Foreshore on the environment

Introduction

20.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology – (river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

20.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

20.3.3 The following section summarises the site effects (both beneficial and adverse) arising from the proposed development at the Blackfriars Bridge Foreshore site and explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume18 of the *Environmental Statement.*

Effects during construction

20.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tug boats (for river barges) that are used to move materials and equipment for the project. This could affect local residents and other nearby sensitive properties. Based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on local residents, other nearby sensitive properties or those using the area around the site for recreation. This is due to the minor increase in pollutant concentrations predicted. Significant beneficial effects are predicted on The President vessel (floating offices and bar), which would be temporarily relocated during construction.

20.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

20.3.6 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. In terms of noise effects from construction works on site, the presence of control measures, such as site enclosures and temporary stockpiles to provide acoustic screening, would help reduce noise effects. No significant noise effects from construction works on site are predicted (on either residential and non-residential properties or users of the local area). Similarly, no significant noise effects from construction traffic (either road-based or river-based) are predicted given the small changes in traffic noise levels.

20.3.7 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

20.3.8 In terms of townscape, significant adverse effects around the Blackfriars Bridge Foreshore site are predicted as a result of the change to the character of the area and the riverside setting. These are due to the temporary construction working area located in the river (cofferdam), site hoarding, construction plant, the intensity of construction activity and the combined effect of construction activity at the nearby Thames Tideway Tunnel Victoria Embankment Foreshore site (Section 19).

20.3.9 People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects, that is their experience of views. Significant adverse effects are predicted on a number of viewpoints, including some residential properties on the opposite bank of the river. As with townscape effects, these are due to the visibility and prominence of the construction works.

20.3.10 Consideration of the amenity of local residents, businesses and users of the nearby Thames Path, and Inner Temple Gardens is provided in the assessment of socio-economics. This takes into account the noise, vibration, air quality, construction dust and visual effects on local amenity. No significant effects on local amenity are likely.

20.3.11 The socio-economics assessment also considers the potential effects on business and pier owner due to the Blackfriars Millennium Pier relocation and the relocation of The President vessel. In accordance with *Thames Tideway Tunnel compensation programme* any reasonable costs and expenditure incurred in association with the relocation would be compensated for and therefore, no significant effects are likely.

20.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that significant transport effects are minimised. Significant adverse effects on pedestrians and cyclists using the Thames Path as well as passengers using Blackfriars Millennium Pier are predicted due to the temporary footpath diversion, which would be necessary to allow safe movement of construction vehicles to and from the site. Significant adverse effects are also predicted on coaches due to the suspension of coach parking during construction.

Figure 20.7 View south along existing Blackfriars Bridge

20.3.13 A study of historical maps, previous archaeological records and research into local history have been undertaken to build up a picture of the possible below ground remains. Construction works on site would involve changes to both above ground features as well as the environment below ground.

20.3.14 There is potential for below ground heritage assets being present at the site, including Roman ship remains and post medieval remains. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

20.3.15 The site and its immediate surrounding also have above ground features of interest, which include Blackfriars Bridge itself (Figure 20.7 and Figure 20.8), the Bazalgette's Victoria Embankment and Temples Conservation Area. Significant adverse effects are likely on historical features above ground including conservation areas, and the setting of historic structures. These are largely due to the change to their historic character and setting caused by the construction works.

Figure 20.8 Construction on the western side of Blackfriars Bridge: 1866-1870 (Image 204606 © Museum of London)

20.3.16 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The site and near site area has not been subject to any major contaminative past land uses. No likely significant effects have therefore been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

20.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the water (commonly termed a ‘pathway’) is created, resulting in the mobilisation of pollution. At this site the below ground structures would be at a depth where groundwater would be present. The pressure of the groundwater could interfere with the construction of the shaft by causing the base of the shaft to move upwards. To prevent this happening and to keep the below ground structures dry, groundwater would be pumped out of the structures and the below ground area where construction would take place (a process known as ‘dewatering’). Dewatering can affect groundwater in two main ways; either it can create a pathway for pollution or it can result in the lowering of groundwater levels, which could affect people who use the groundwater for water supply. A number of control measures would be applied to reduce dewatering effects; this includes limiting the amount of dewatering and stabilising the ground to remove the pathway. Given the application of these measures, no significant effects on groundwater resources or quality would occur.

20.3.18 As with groundwater, surface water quality can also be affected by the creation of pathways for pollutants. At this site, a route for pollutants to enter the water may arise during the construction of the temporary cofferdam within the River Thames. This is because pollutants could be disturbed by excavation in the foreshore. Another route for pollutants could be from substances used in construction (for example oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants from getting into the river in this way. Pollutants would either go into existing foul drains or be collected on site. Based on the application of these measures, no significant effects on surface water quality would occur.

20.3.19 The construction of the temporary construction works in the foreshore of the River Thames (cofferdam) at this location would lead to some changes in the flow of water in the river, which may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with appropriate protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

20.3.20 Flooding may occur from various sources for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, fluvial, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, the cofferdam would be constructed in the foreshore to the same height as the existing flood defence. Based on the assessment for the site, there would be no change in flood risk as a result of construction works.

20.3.21 The River Thames provides an important habitat for river ecology. As most of the construction works at Blackfriars Bridge Foreshore site would take place within the river, this may have an effect on its ecology. The total temporary landtake from habitats within the river would be a small percentage of the total area of the River Thames and its tributaries, which are designated for their nature conservation value. As such, no significant effects due to landtake are predicted on river habitats and associated species of plants and animals. There is also likely to be some disturbance of habitats and species due to barge movements but as this would be over a limited area, no significant effects are predicted.

20.3.22 As described above, the presence of the cofferdam in the river would lead to some changes in the flow of water in the river. This could affect the speed of flow and consequently could change the area over which sediments are deposited. Such localised changes are not predicted to result in any significant effects on aquatic ecology.

20.3.23 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including noise screening and avoiding direct lighting of the river. No significant adverse effects are therefore predicted.

20.3.24 Construction effects for land based ecology at this site have not been assessed on the basis that there are no notable species or habitats known to be present, or the potential for them to be present, on or adjacent to the site.

20.3.25 No other developments are planned nearby during the same timeframe that would interact with the construction work at the Blackfriars Bridge Foreshore site and therefore no significant cumulative effects are likely.

Effects during operation

20.3.26 The operational site would include a ventilation structure, which would treat air released from the tunnel. The air would be treated by passing through filters housed in a below ground air treatment chamber. Air would be then released from the ventilation columns comprising five, 4 - 8 metre high ventilation columns on the new structure and a further ventilation column, 4 - 8 metres in height, into the new wall adjacent to the ramp. The heights of the ventilation columns would allow the elevated release of expelled air. This would ensure that there are no likely significant effects from odour during operation.

20.3.27 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic have been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

20.3.28 No significant adverse effects on viewpoints and the townscape around the site are predicted (Figure 20.10). Minor beneficial effects are predicted on the nearby Whitefriars Conservation Area and on the view south from the office buildings along the Victoria Embankment. These are due to the proposed improvement to immediate riverside setting through the removal of existing structures and the creation of a new area of public realm.

20.3.29 Associated with this, significant beneficial effects are likely on local amenity due to the proposed provision of public amenity space along the Thames Path.

Figure 20.9 Existing public realm looking east along Victoria Embankment

20.3.30 Maintenance and routine inspections of the operational infrastructure would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. Space to locate the cranes may require the temporary diversion of the Thames Path. The ten yearly maintenance visits may also lead to some temporary, short-term delay to users of the local road network. However, these operational activities would not lead to significant effects.

20.3.31 No significant effects are predicted on pier operator and passengers using the relocated Blackfriars Millennium Pier as the Thames Path would be reopened.

20.3.32 The above ground operational structures at the Blackfriars Bridge Foreshore site, including the permanent structure projecting into the river, are likely to change the setting of nearby heritage assets and conservation areas. As a result, significant adverse effects are likely on Blackfriars Bridge, Whitefriars Conservation Area and the Embankment Wall.

20.3.33 While groundwater levels and quality could be affected by seepage into, and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed and therefore no significant effect is predicted. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

20.3.34 The proposed permanent structures at this site have the potential to affect the movement of water within the river, and consequently deposition and erosion of sediments. However, protective measures for any affected structures would be included in the operational development. No significant adverse effects are therefore predicted.

20.3.35 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected, resulting in significant benefits to water quality.

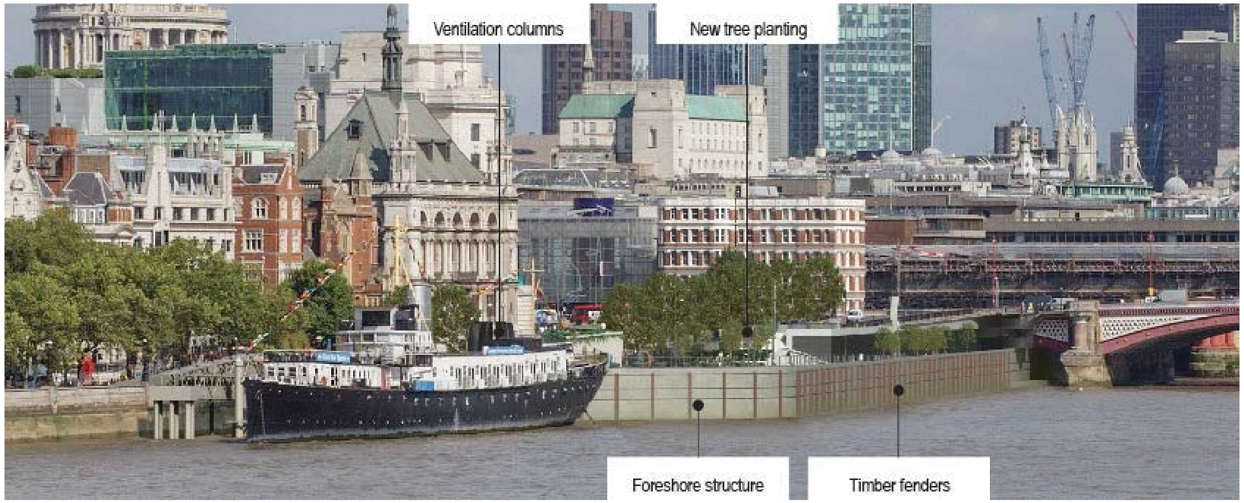
20.3.36 The improvements in water quality would benefit river based ecology, although fish populations at this site are relatively limited due to habitat quality and the presence of the vertical river wall. This means that more substantial (and hence significant) improvements are not predicted.

20.3.37 There would be a significant adverse effect on river habitats as a result of the permanent foreshore structure in the river. To compensate for the permanent loss of foreshore habitat at this site, and other sites where permanent works in the river are proposed, a series of compensation measures have been developed. These include schemes to improve access to or creation of habitats elsewhere along the River Thames and its tidal tributaries.

20.3.38 The fully built project would also not alter the existing flood risk and the site would be defended by new flood defences. Therefore the operational flood risk effects would not be significant.

20.3.39 The assessment has considered other developments that are planned nearby that could interact with the operation of the development site. No likely significant cumulative effects have been identified.

Figure 20.10 Existing site and visualisation of proposed development site



20.3.40 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. A number of design measures would be included to prevent any contamination related to the operation of the Thames Tideway Tunnel and so land quality effects during operation have not been assessed.

c. As for the construction phase, given the lack of potential for land based ecology at the site, operational effects were not assessed.

20.4 Further information

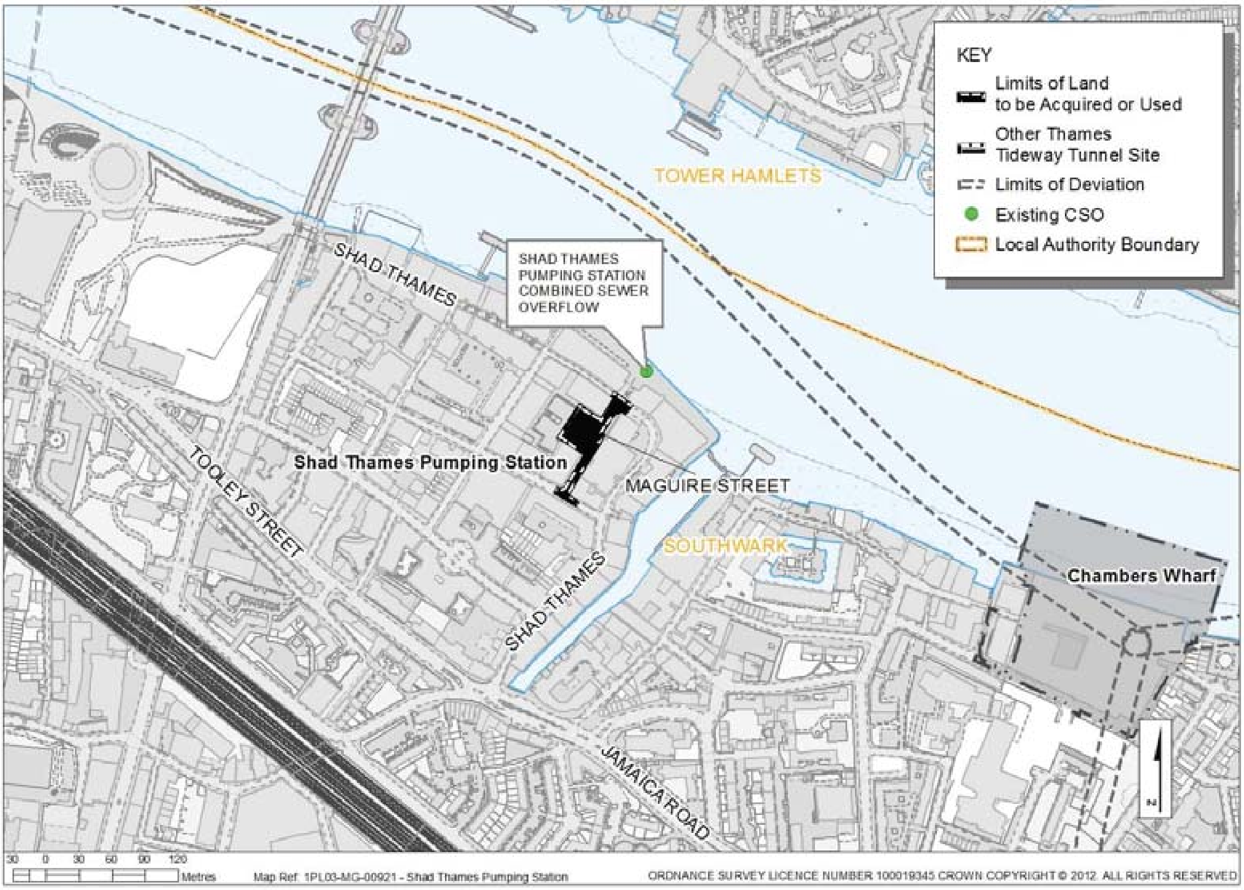
20.4.1 Further information regarding the assessment of the Blackfriars Bridge Foreshore site can be found in Volume 18 of the *Environmental Statement*.

21 Shad Thames Pumping Station

21.1 Existing site context

21.1.1 Shad Thames Pumping Station is an existing Thames Water pumping station site located in the London Borough of Southwark.

Figure 21.1[1] Location of proposed Shad Thames Pumping Station site

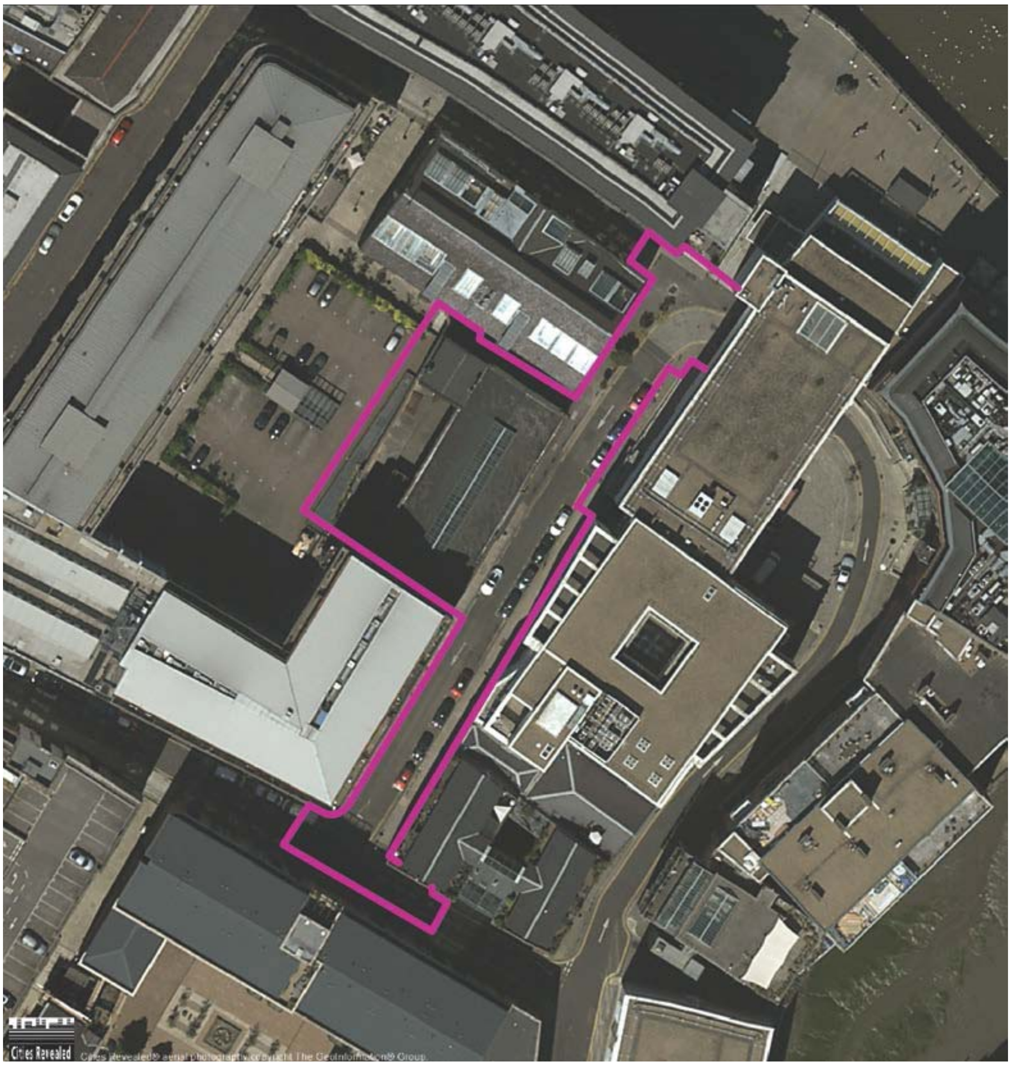


21.1.2 The site comprises the pumping station and a section of adjacent land including part of Maguire Street.

21.1.3 The site is bounded to the north by Wheat Wharf apartments, to the east by the Clove Building which includes the Design Museum, to the south by Tamarind Court and to the west by a private car park serving Vanilla and Sesame Court. The surrounding area comprises a mixture of residential, offices and commercial development. Figure 21.1 to Figure 21.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Figure 21.2 Aerial view of existing site



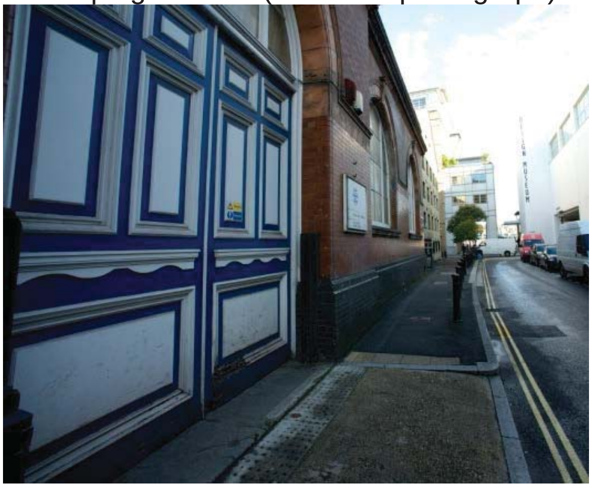
21.1.4 Existing access to the pumping station is from Maguire Street, via a one way system along Shad Thames and Gainsford Street. The site is located approximately 40m from the River Thames.

21.1.5 The site sits within an air quality management designation, which covers the northern part of the London Borough of Southwark. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

21.1.6 Wheat Wharf apartments are Grade II listed and adjacent to the site. The site lies within the Tower Bridge Conservation Area while the St Saviours Dock Conservation Area is located immediately to the east of the site. The site also lies within the Borough, Bermondsey and River Archaeological Priority Zone. There are no other environmental designations on or adjacent to the site.

Figure 21.3 Shad Thames Pumping Station - site context

View along Maguire Street with Shad Thames Pumping Station (left in the photograph)



Entrance to pumping station

Superintendent's residence to rear (west) of pumping station

Street trees on Maguire Street

21.2 Proposed development

21.2.1 The purpose of this 0.2 hectare site is to modify the operation of Shad Thames Pumping Station which currently discharges untreated sewage into the River Thames on average 15 times each year, at a total volume of 92,000 cubic metres. This is equivalent to approximately 37 Olympic sized swimming pools.

21.2.2 Once the modifications have been undertaken to allow some flows to be stored and subsequently returned to the existing sewer system, there would be approximately four discharges of untreated sewage into the River Thames per year from this site. The pumping station and the existing combined sewer overflow would not be connected to the main tunnel at this location.

21.2.3 Construction at the Shad Thames Pumping Station site is assumed to start in 2018 and be complete by 2019.

21.2.4 The proposed modifications at Shad Thames Pumping Station would include modifications to the existing pumps and internal pipe work and provision of additional new pumps and associated chamber required to house the pumps. The new chamber would be located within the existing pumping station and require excavation within the pumping station. An additional vehicle access would also be needed to access the new pumps. This access, from Maguire Street, would require alterations to the front of the Shad Thames Pumping Station building. The average peak daily number of lorry trips at this site would be seven.

21.2.5 In addition, the existing three storey facilities building behind the existing pumping station would be demolished and replaced with a new electrical switchgear and facilities building.

21.2.6 Excavated material arising from construction of the new pump chamber, demolition material and building materials would be transported to and from the site by road.

21.2.7 The works would also involve modification of existing sewers in Maguire Street and Gainsford Street. Sewer modification work in Maguire Street would require closure of a section of Maguire Street. During this period traffic on the section of Shad Thames between Gainsford Street and Maguire Street would be temporarily modified to allow vehicle movement in both directions under traffic signal control. Work in Gainsford Street would require the temporary closure of a short section of Gainsford Street between Shad Thames and Maguire Street.

21.2.8 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, ensuring safety for road users and pedestrians by controlling movement of vehicles, and restricting working hours to limit the effects of noise on neighbours.

21.2.9 During construction, vehicles would access the construction site from Shad Thames and leave the site via Maguire Street and Gainsford Street. The average peak daily number of lorry trips at this site would be seven.

21.2.10 The plan below (Figure 21.4) shows the layout of the proposed development for which consent is sought. The plan shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

21.2.11 Most of the works would be located either underground or within the existing pumping station. However, the new electrical equipment building at the rear of the pumping station building would be approximately 9.5 metres high. A 9.5 metre high ventilation column, needed for ventilation of the new pumps, would be located adjacent to this building. These are shown in an illustrative above ground plan in Figure 21.5.

21.2.12 Once construction works are complete temporary highway restrictions would be removed. Once operational, routine maintenance inspections would be made every one to three months. Access to the site would be by use of the existing access gates to Shad Thames Pumping Station and one new permanent access point into the pumping station from Maguire Street.

Figure 21.4 Proposed development at the Shad Thames Pumping Station site

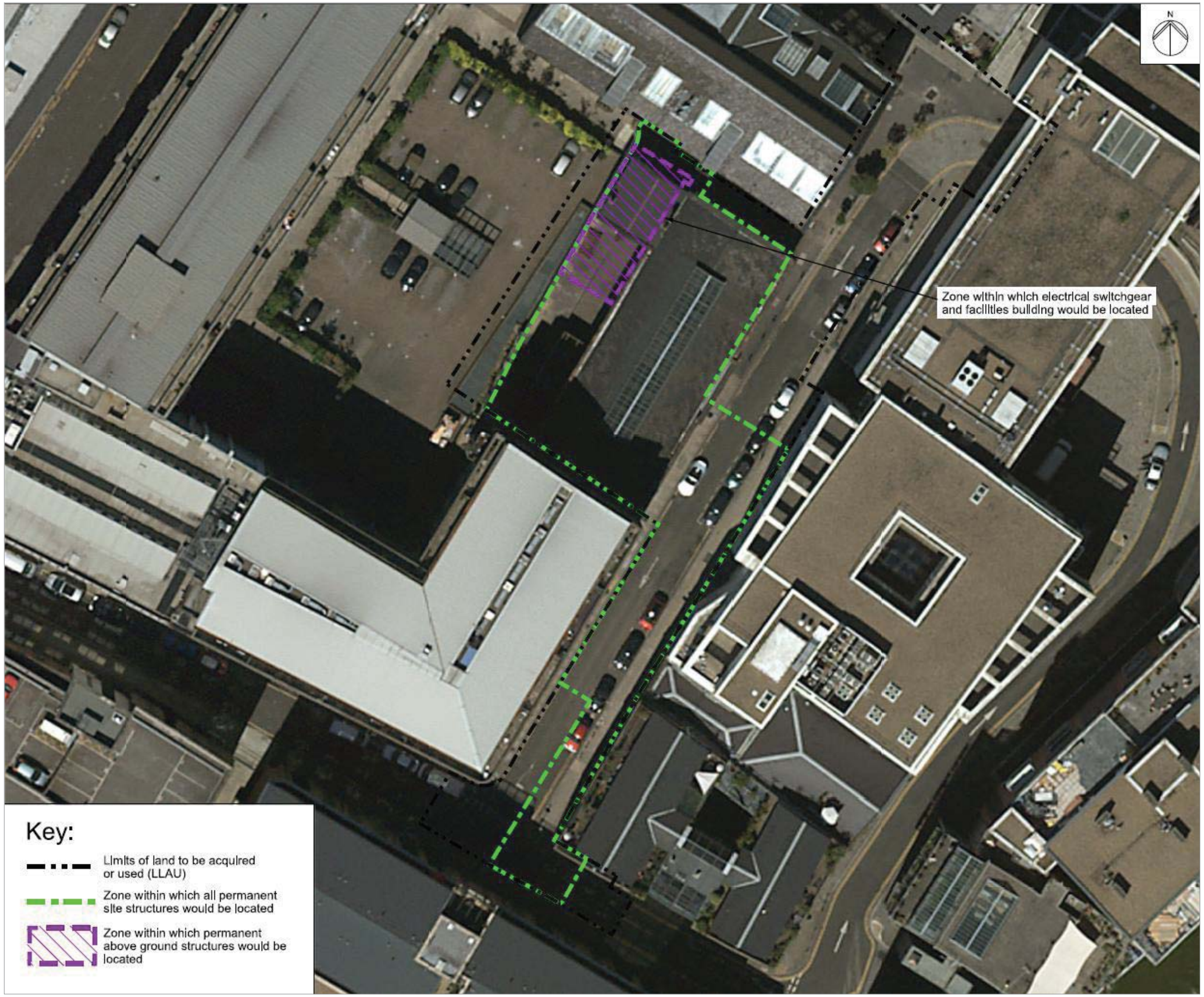
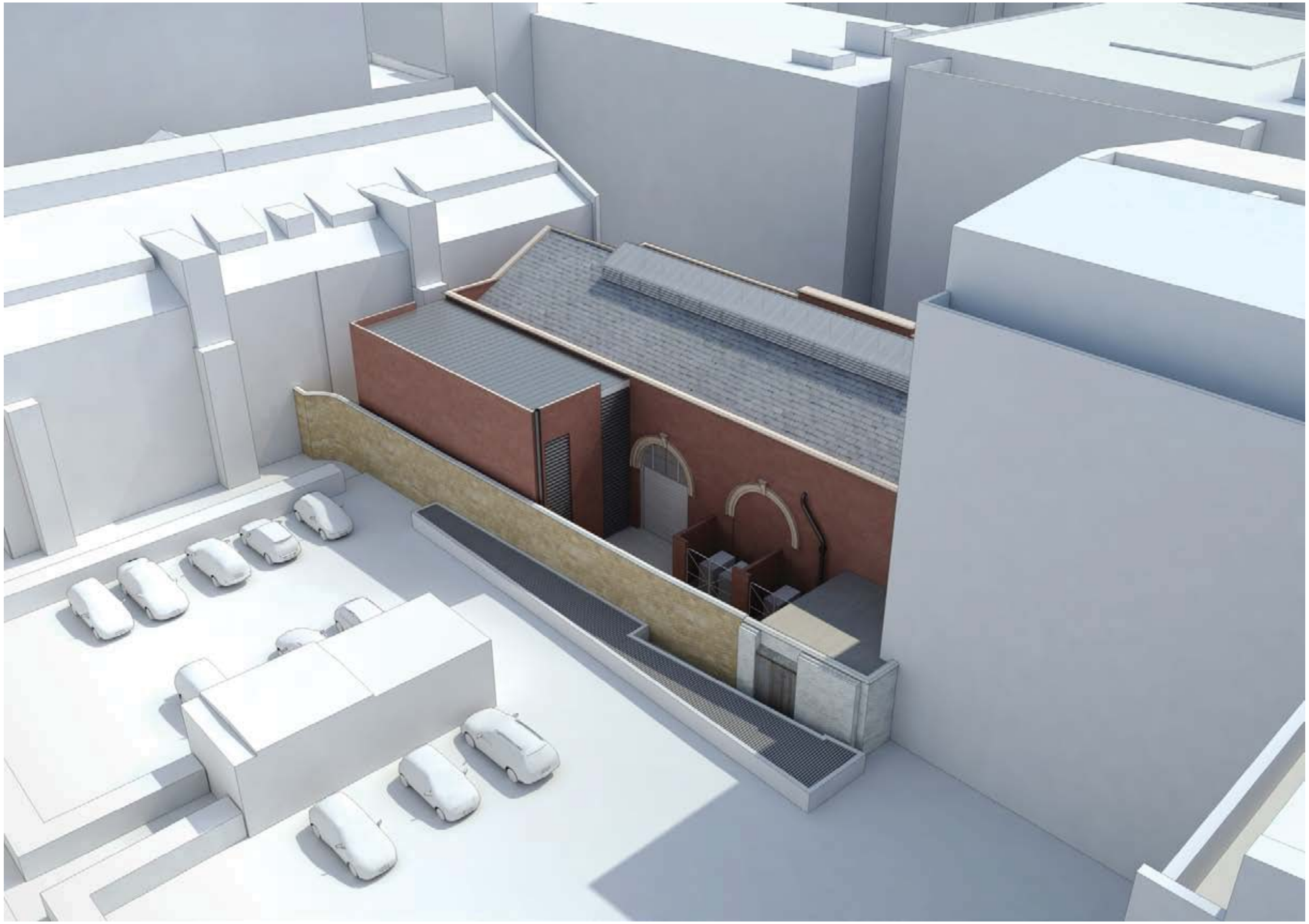


Figure 21.5 Shad Thames Pumping Station site – illustrative aerial view



21.3 Effects of the proposed development at Shad Thames Pumping Station on the environment

Introduction

21.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology – (land based and river based)

c. Historic environment

d. Noise and vibration

e. Townscape and visual

f. Transport

g. Water (surface)

h. Flood risk

21.3.2 For the following topics, there would be no significant effects at this site either during construction or operation and so no assessment has been undertaken:

a. Effects on socio-economics have not been assessed for either the construction or operational phases as the works would be carried out primarily within the existing pumping station building. Any potential effects associated with disruption to local residential amenity, or from increased noise are covered by the air quality and noise and vibration assessments.

b. Groundwater and land quality have not been assessed because the works at the site would not be at a depth where substantial groundwater would be encountered and only a relatively small volume of soil would be excavated as part of the works and it is not thought this would have land quality effects.

21.3.3 The assessment of each topic listed in paragraph 21.3.1has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposal on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

21.3.4 The following section summarises the site effects (both beneficial and adverse) arising from the proposed development at the Shad Thames Pumping Station site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the main tunnel is built and operational. The full details for each topic are contained in Volume 19 of the *Environmental Statement*.

Effects during construction

21.3.5 During construction there may be an increase in pollutants that affect air quality from vehicles that would be used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents, people who use the Thames Path for recreation and visitors to the Design Museum. Pollutant levels are currently high across the London Borough of Southwark. However, it is predicted that there would be ongoing improvements in background air quality attributable to improvements in vehicle technology over the coming years. Based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on the majority of local residents or those people using the area around the site for recreation. There would however be significant adverse air quality effects on the residents of Wheat Wharf and Tamarind Court. This would be due to the increase in emissions predicted at these residential properties from construction works, although pollution levels would still be lower than they are at present.

21.3.6 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. Controls that would be applied during construction would include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

21.3.7 Noise could arise from construction activities, namely the movement of construction traffic on roads outside the site and noise from equipment used on site. In terms of noise effects from construction works on site, the presence of control measures such as a site hoarding around the site would help reduce noise at some receptors. However, there would still be significant adverse noise effects at the front of Tamarind Court (the section of the building closest to the pumping station). Significant adverse effects are also predicted at Coriander Court (the sections of the property that face Maguire Street and Gainsford Street). No effects are anticipated at the rear of Tamarind Court or other properties close to the site.

21.3.8 It is not possible to further reduce the noise effects through on site controls. However, the residents that would be affected by noise may be eligible to apply for noise insulation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*, which if accepted, would reduce the effects to not significant.

21.3.9 Vibration related to construction activity can affect nearby properties and their inhabitants. Significant adverse vibration effects have been predicted at Tamarind Court, Clove Building and Coriander Court (the sections facing Maguire Street and Gainsford Street). These effects would be due to piling that would be undertaken during highway works. It may be possible to reduce the vibration effects by using low vibration piling methods. If ground conditions at the Shad Thames Pumping Station site are such that these methods could be implemented, effects would not be significant. However, the specific ground conditions encountered would not be known until piling is underway. If ground conditions do not allow these methods to be implemented then the residents that would be affected by vibration may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme*.

21.3.10 A significant adverse effect on the townscape of the site is predicted during construction. This is due to the change to the setting of the site from the demolition of buildings and the introduction of construction activity.

21.3.11 There would also be significant adverse effects on two viewpoints; the view from residences at the northern end of Vanilla and Sesame Court and the view from the southern end of Vanilla and Sesame Court. These effects would be largely down to the visibility of the demolition of the existing facilities building and construction of the new building.

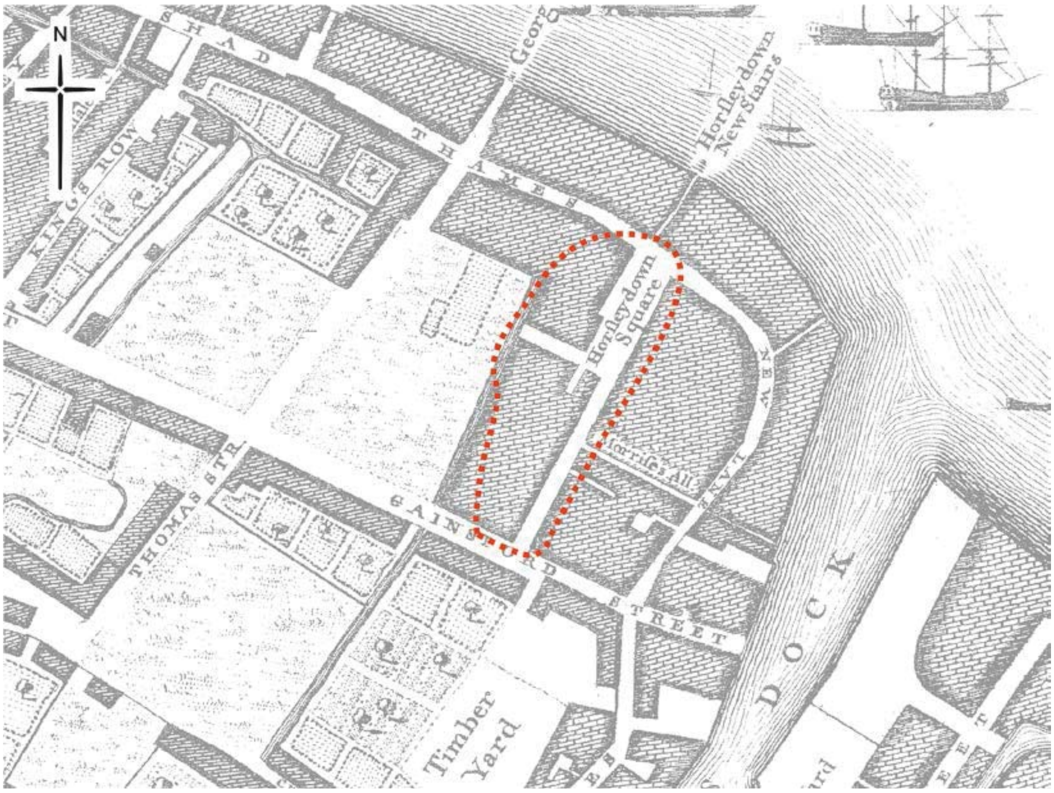
21.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that no significant transport effects would occur.

21.3.13 Construction work on site would involve changes to both above ground features as well as the environment below ground. The site was assessed to identify potential above and below ground features of interest. This included a review of historical maps, previous archaeological records and research into local history (Figure 21.5).

21.3.14 The above ground features within and adjacent to the site that have been considered in the historic environment assessment include the existing Shad Thames Pumping Station building (Figure 21.3). Although this building is not listed, it is mentioned in the Tower Bridge Conservation Area appraisal document as a building that makes a positive contribution to the overall character of the conservation area. The only adverse significant effect would occur at the listed Wheat Wharf building as a result of the construction works detracting from the building's setting.

21.3.15 Whilst some below ground heritage assets may have been removed when the pumping station was originally built, the historic environment assessment has identified that there is potential for prehistoric finds and remains from the 17th century onwards. Given this, archaeologists would be present on site to observe construction and to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

Figure 21.6 Rocque's map of 1746



21.3.16 While the site lies inland, construction activity could affect water quality in the River Thames through rainfall carrying pollution from the site to the river. However, the drainage management measures proposed as part of the application for development consent to minimise contamination of surface water would ensure that no significant effects on surface water occur.

21.3.17 Flooding may occur from various sources for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. Based on the assessment, there would be no change in flood risk during construction.

21.3.18 During construction, control measures would be in place such as noise screening and minimising light spillage. The effects on species that use the site and immediate surrounds would be minimal. The site is an area that is of limited value to land based ecology. The clearance of shrubs, trees and some existing structures on site would not have significant effects on land based ecology. At the end of construction, trees would be replanted on Maguire Street. Therefore, there would be no significant effects on ecology.

21.3.19 The assessments have considered other developments that are planned nearby that would interact with the construction work at the Shad Thames Pumping Station site. No likely significant cumulative effects have been identified in the assessments.

Figure 21.7 Interior of the Thames Water owned Shad Thames Pumping Station

Effects during operation

21.3.20 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. Maintenance would be undertaken from within the site as part of the existing pumping station maintenance routine. This relatively minor operational activity would not lead to significant transport effects.

21.3.21 Noise and vibration from operational plant, maintenance activities, as well as from operational traffic has been considered. Any noise generated by the new pumps and other plant equipment would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

21.3.22 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

21.3.23 The effect of the modification works at this site would be to reduce flows of sewage into the River Thames from the discharge point to which the site is connected. The reduction in discharges would result in significant beneficial improvements to water quality. Associated with the improvement in water quality would be beneficial effects on the river based ecology, although effects would not be significant at the site specific level at this location.

21.3.24 The design of the development present at the Shad Thames Pumping Station site and the nearby Chambers Wharf site during operation could affect the setting of the Tower Bridge Conservation Area and Wheat Wharf building. The assessment of historic environment however concluded that operational developments at both these sites would not result in likely significant effects on aspects of historical interest, above or below ground.

21.3.25 The assessments have considered other developments that are planned nearby that would interact with the construction work at the Shad Thames Pumping Station site although no likely significant cumulative effects have been identified.

21.3.26 Operational effects at this site have not been assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, an assessment of air quality from traffic has not been undertaken.

b. Odour has not been included in the assessment as there would be no new odour sources at the site.

c. Operational townscape and visual effects have not been assessed since the only visible above ground structure would be the replacement building, which would be similar in size and character to the building to be demolished.

d. Given that the operational site would be within the existing pumping station complex, the infrequent maintenance requirements and that the design would involve no new lighting, significant effects on land based ecology are not likely, and were therefore not assessed.

21.4 Further information

21.4.1 Further information regarding the assessment of Shad Thames Pumping Station can be found in Volume 19 of the *Environmental Statement*.

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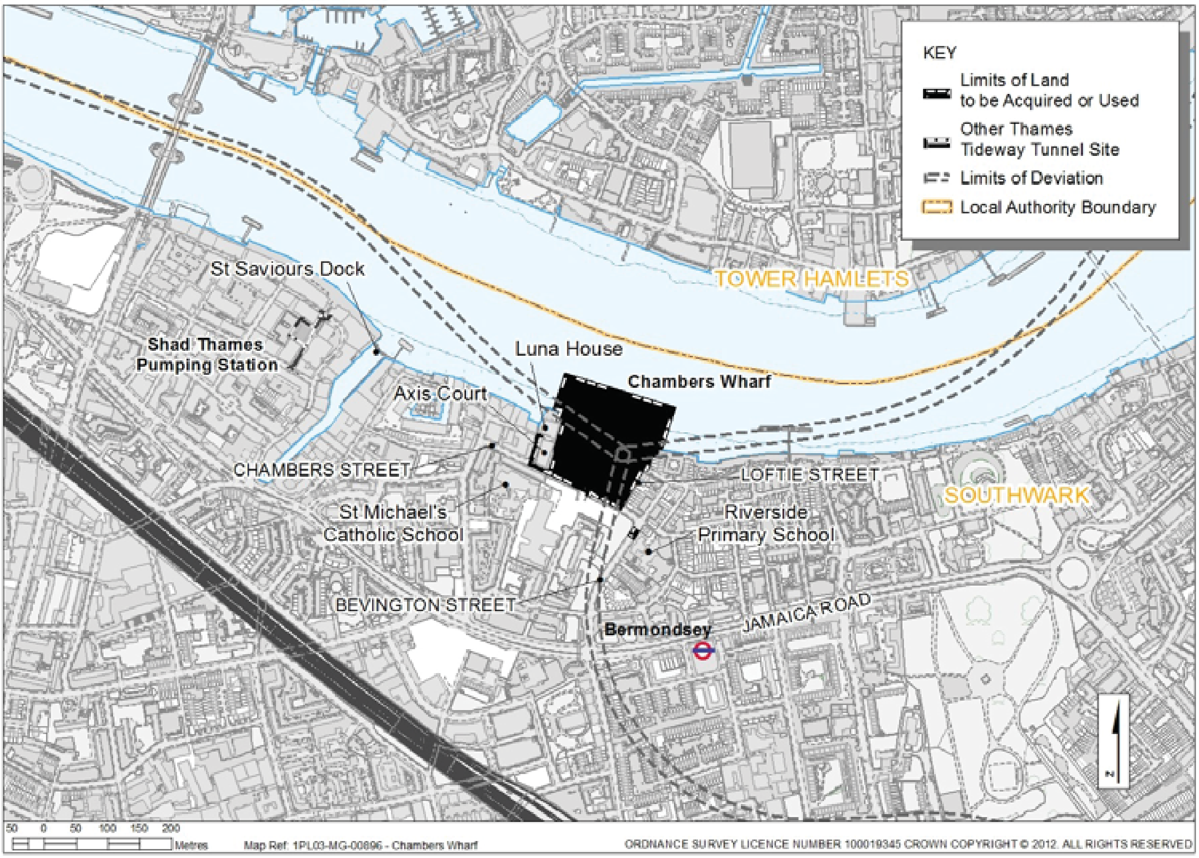
22 Chambers Wharf

22.1 Existing site context

22.1.1 The proposed development site at Chambers Wharf is located in the London Borough of Southwark on the southern bank of the River Thames. It would comprise an existing area of previously developed and now cleared land and an adjacent area of foreshore (including a piled deck). A small highway worksite would be required for a short period in nearby Bevington Street, located at the junction with Chambers Street.

Figure 22.1[1] Location of the proposed Chambers Wharf site



22.1.2 Within the hoarded part of the main site there is currently hardstanding, previously developed land (which has recently been cleared in preparation for development). A deck projects outward into the river from the line of the present river wall, supported by piles on the foreshore adjacent to the river wall.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Figure 22.2 Aerial view of existing site

22.1.3 The hoarded part of the main site would be bounded to the north by the River Thames, to the east by Loftie Street and Bermondsey Wall West, to the south by Chambers Street and to the west by residential apartments on East Lane. On the riverbank to the north of Loftie Street are two, three-story residential blocks in Fountain Green Square. On the southern side of Chambers Street there is an area of cleared brownfield land. Further south is St Michael's Catholic College. Luna House and Axis Court are large residential blocks to the west of the site. Figure 22.1 to Figure 22.3 show the site and local context.

22.1.4 Existing access to the main site is from Jamaica Road (A200) to the south east via Bevington Street to Chambers Street and Loftie Street.

Figure 22.3 Chambers Wharf – site context

Existing view of site from river

Existing view of site looking west

Existing view of site from river

Nearby residential properties at Fountain Green Square

22.1.5 The site sits within an air quality management designation, which covers the northern part of the London Borough of Southwark. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

22.1.6 The foreshore areas fall within the River Thames and Tidal Tributaries Site of Importance for Nature Conservation.

22.1.7 The nearest listed structures to the site are the Grade II listed East Lane Stairs and Grade II listed No. 33 Bermondsey Wall West immediately south of the western end of the site, and Grade II listed Nos. 38 and 40 Bermondsey Wall West approximately 30m to the west of the main site.

22.1.8 The site is outside the locally designated St Saviour’s Dock Conservation Area which is to the west. The site lies within the Borough, Bermondsey and River Archaeological Priority Area.

22.1.9 There are no other environmental designations on or adjacent to the site.

22.2 Proposed development

22.2.1 The purpose of this 2.8 hectare site would be to facilitate construction of two sections of the main tunnel and one connection tunnel. In addition a small site area of 0.02 hectares would be used for provision of a pedestrian crossing in Bevington Street.

22.2.2 One section of the main tunnel would be constructed between the Kirtling Street site, to the west, which is in the London Borough of Wandsworth and the Chambers Wharf site. The second section of main tunnel would be constructed between the Chambers Wharf site and the Abbey Mills Pumping Station site, to the east, which is in the London Borough of Newham. The Greenwich connection tunnel would be constructed between the Greenwich Pumping Station site, to the south-east, and the Chambers Wharf site.

22.2.3 There are no combined sewer overflows at this site, however, the Greenwich connection tunnel is required to collect and convey intercepted discharges of untreated sewage from the Earl Pumping Station, Deptford Church Street and Greenwich Pumping Station sites to the main tunnel. Untreated sewage from these sites currently discharges into the River Thames.

22.2.4 Construction at Chambers Wharf is assumed to start in 2016 and be complete by 2021.

22.2.5 Prior to commencement of the tunnelling works, a temporary area of reclaimed land in the foreshore, called a cofferdam, would be constructed to create an extended work site sufficient to enable the construction of the shaft, tunnels and other structures. This would be retained by steel piles, which would be built up to ensure that the site and surrounding area stay protected from flooding. The temporary construction area (cofferdam) would be filled to form an extension of the existing Chambers Wharf site. Barges would be used to transport fill material for the cofferdam. The existing wharf decking that extends over the river would be removed.

22.2.6 A shaft approximately 58 metres deep with an internal diameter of approximately 25 metres would be constructed on the eastern side of the site behind the temporary cofferdam and behind the existing line of the river wall.

22.2.7 The section of main tunnel between the Chambers Wharf site and the Abbey Mills Pumping Station site would be built using a tunnel boring machine. This machine would be lowered into the Chambers Wharf site shaft and, once underway, would travel eastwards working 24 hours per day to help make sure that the work is completed safely, efficiently and in the least time. The tunnel boring machine would progressively excavate the ground and line the tunnel with precast concrete segments. The excavated material would be transported via the shaft to the site and then removed from site as described below. The segments would be joined together to make the circular outer lining of the tunnel. When the tunnel boring machine reaches the shaft at Abbey Mills Pumping Station site it would be dismantled and removed by crane at this site. It has been assumed that an inner lining, called a secondary lining, would be constructed from both the Abbey Mills Pumping Station and Chambers Wharf sites, by pumping wet concrete into temporary supports used to form the final inside shape of the tunnel.

22.2.8 The shaft at Chambers Wharf would be used to take all excavated material out of the tunnel as the tunnel boring machine progresses towards Abbey Mills. It would also be used to supply precast concrete segments to the tunnel boring machine.

22.2.9 The temporary cofferdam would enable barges to be used during the construction period. Most excavated material from the shaft, other structures, the Chambers Wharf to Abbey Mills tunnel and sands and gravels used to make concrete for the inner lining of the tunnel would be transported using barges. This would minimise the number of lorry trips to and from the site.

22.2.10 Tunnel boring machines arriving at the Chambers Wharf shaft from both the Kirtling Street and Greenwich Pumping Station sites would be dismantled at the base of the shaft and removed by crane. These tunnels would then be provided with an inner lining, as described above, using the shafts at the Chambers Wharf, Kirtling Street and Greenwich Pumping Station sites.

22.2.11 All construction would be controlled to reduce potential impacts. There would be an enclosure located over the shaft for the duration of 24 hour working to reduce noise effects on local residents. In addition, there would be other controls in place throughout the construction phase to reduce potential impacts. These would include measures such as damping down materials on site roads to control dust, and ensuring safety for road users and pedestrians by controlling movement of vehicles.

22.2.12 During construction vehicles would access the site from Chambers Street. The average peak daily number of lorry trips at this site would be 55 and the average peak daily number of barge trips would be three.

22.2.13 The plan below (Figure 22.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the location of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

22.2.14 To help explain this information, the schematic diagram below (Figure 22.5) illustrates where the structures may be located within these zones.

22.2.15 While most of the structures would be underground, three ventilation columns and an electrical and control kiosk would be located above ground. The ventilation columns would be 4 to 8 metres high and the control kiosk 2.5 metres high.

22.2.16 The height of the three new ventilation columns in combination with below ground filters, included in the below-ground structures, would control odour and minimise effects on surrounding residents. These are shown in an illustrative above ground plan in Figure 22.6. The buildings shown in the illustrations would be built by a private developer once the Thames Tideway Tunnel is complete and would not be present in the early years of the tunnel’s operation.

22.2.17 Once the construction works are complete, the temporary cofferdam would be removed. Barges would be used to remove the fill material and minimise lorry movements.

22.2.18 No operational lighting would be provided, except for a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

22.2.19 Once operational there would be routine inspections to the site every three to six months and important maintenance work carried out every ten years. Access to the site would be from Loftie Street. This would remain the access point for the works when the site is incorporated into the planned residential development of the Chambers Wharf site.

Figure 22.4 Proposed development at the Chambers Wharf site

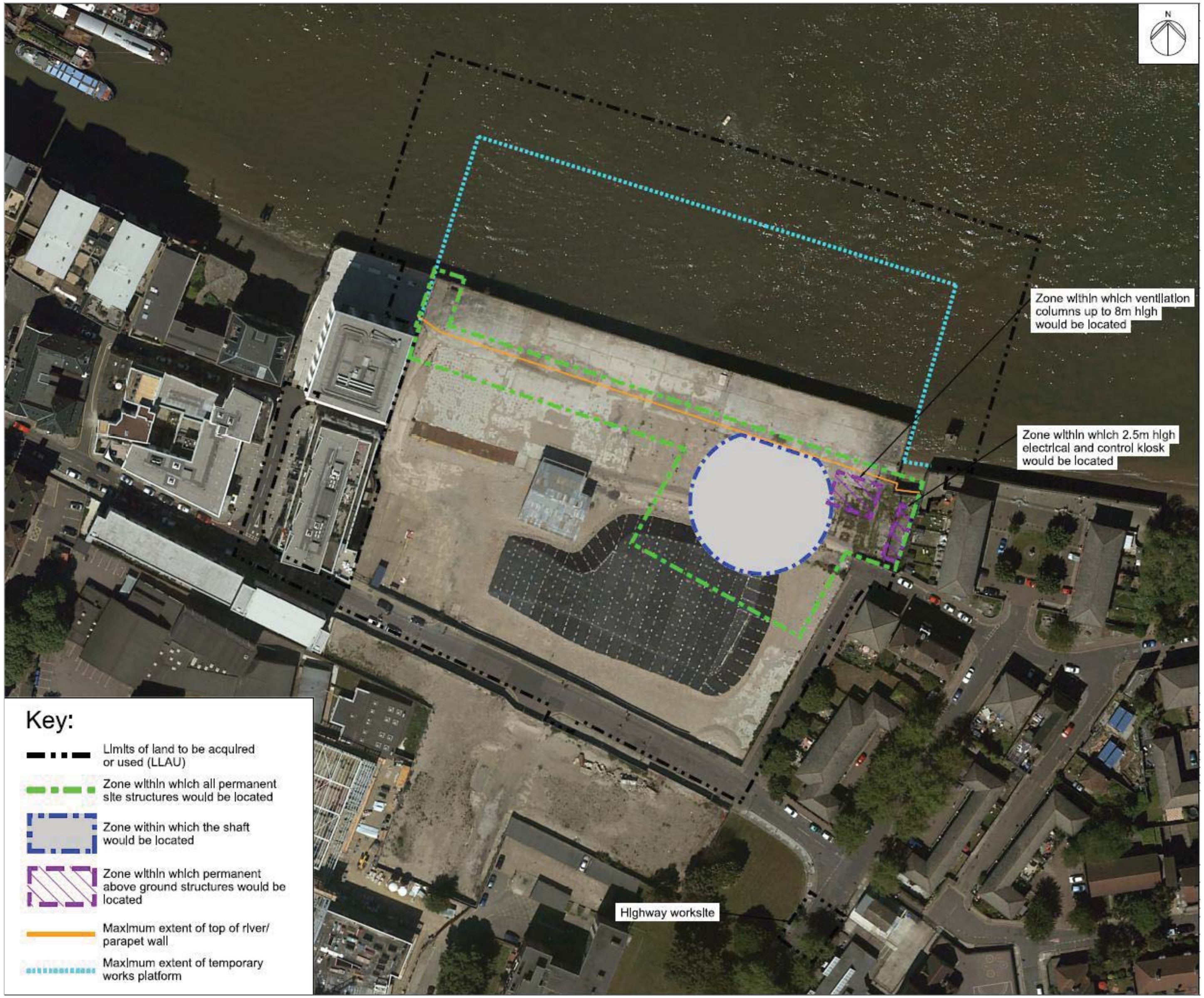


Figure 22.5 Schematic layout at the Chambers Wharf site

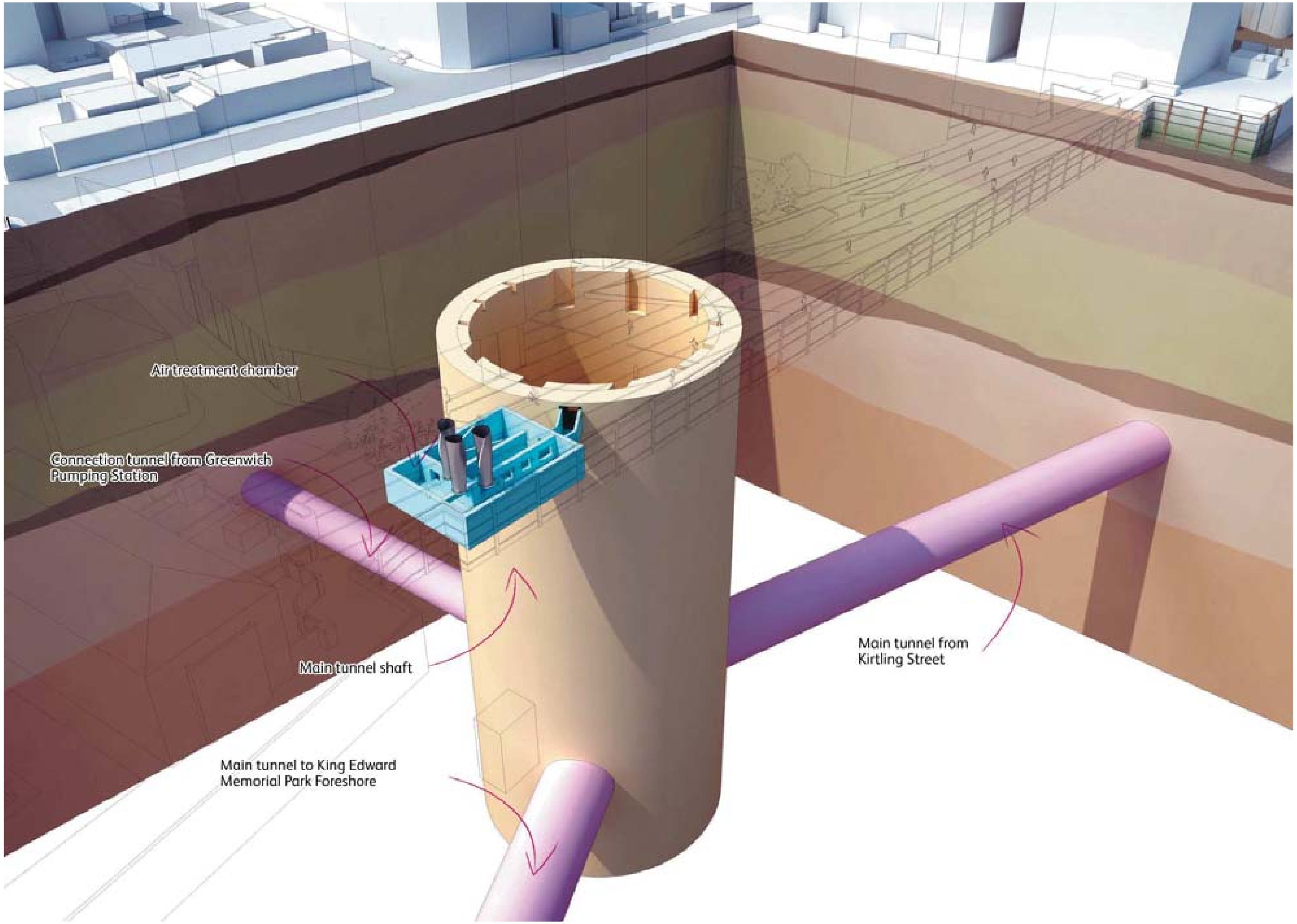


Figure 22.6 Chambers Wharf site – illustrative aerial view

22.3 Effects of the proposed development at Chambers Wharf on the environment

Introduction

22.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

22.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 with full details contained in Volume 2 of the *Environmental Statement*.

22.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Chambers Wharf site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the main tunnel is built and operational. The full details for each topic are contained in Volume 20 of the *Environmental Statement*.

Effects during construction

22.3.4 During construction there may be an increase in pollutants that affect air quality from vehicles used to move materials and equipment including road traffic and tugs used for river barges. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties including St Michael's Roman Catholic School. Pollutant levels are currently high across the London Borough Southwark. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on nearby properties. This is due to the small increase in pollutant concentrations predicted.

22.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then be raised as dust when disturbed by other vehicles. The controls that would be applied including dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

22.3.6 Noise could arise from construction activities including the movement of tugs pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. Noise control measures would be put in place at the site during construction to minimise effects from construction activities. A noise enclosure would be provided over the shaft at times when 24 hour working is required. However, significant adverse noise effects from the construction site are still likely at Axis Court and Luna House due to on site construction equipment and at Luna House and 8-14 Fountain Green Square due to river based construction traffic. It would not be possible to further reduce the effect at these locations through on site controls. The residents of Luna House may be eligible to apply for noise insulation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*. Application of these measures would mean there would be no significant effects related to noise at Luna House. Predicted noise levels at Axis Court and 8-14 Fountain Green Square do not exceed the thresholds for noise insulation. These properties may, however, be eligible to apply for compensation under the *Thames Tideway Tunnel compensation programme.*

22.3.7 Vibration related to construction activity can affect nearby properties and their inhabitants. Significant adverse effects from vibration are predicted at Luna House and 8-14 Fountain Green Square in relation to piling. It may be possible to reduce the vibration effects by using low vibration piling methods. If ground conditions at the Chambers Wharf site are such that these methods could be implemented, effects would not be significant. However, the specific ground conditions encountered would not be known until piling is underway. If ground conditions do not allow these methods to be implemented then the residents that would be affected by vibration may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme.*

22.3.8 In terms of townscape, significant adverse effects on most of the surrounding townscape character areas are predicted during the construction phase (Figure 22.10). This is due to the change of setting in relation to construction activity, presence of the cofferdam and barge loading. Similarly, significant adverse effects would occur at eight of the nine residential viewpoints and three of the four recreational viewpoints in relation to the changes listed above as well as visibility of night time lighting on the site and presence of the noise enclosure in some views. Where viewpoint are located in the background of the view or are more intermittent or screened, these effects are not significant.

22.3.9 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity including residents and schools. It also considers local land uses such as nearby amenity space and the Thames Path.

22.3.10 As significant noise and visual effects are anticipated, the effects on the amenity of residents close to the site would be significant. Residents affected by noise may be able to apply for noise insulation or temporary re-housing. Residents may also be eligible to apply for compensation through the Thames Tideway Tunnel project compensation programme which has been established to address claims of exceptional hardship or disturbance. The amenity effects on users of local schools (including St. Michael's Catholic College shown in Figure 22.7), and the Thames Path would not be significant.

Figure 22.7 St. Michael's Catholic College (looking west from Llewellyn Street)

22.3.11 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that transport effects during construction would not be significant at this site.

22.3.12 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up (Figure 22.8). Construction work on site would involve changes to both above ground features as well as the environment below ground.

22.3.13 Information gathering has revealed that remains could include evidence of prehistoric occupation and Roman remains. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

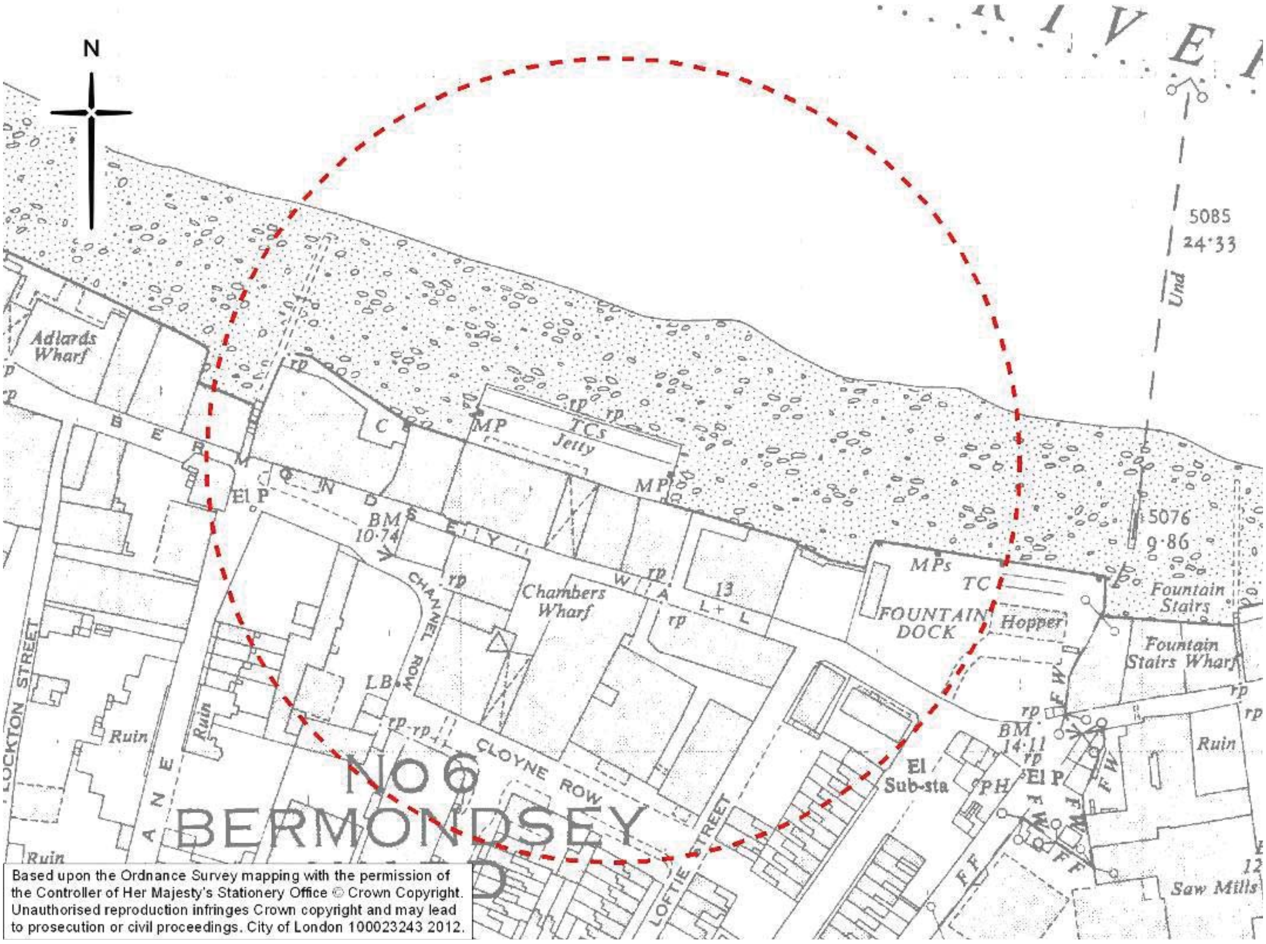
22.3.14 There would be no significant effects on the setting of the St Saviour's Dock Conservation Area, because the construction works would be some distance away in views of the conservation area and would be screened from within the area by existing buildings.

Figure 22.8 Thames Riverscape showing Bond's Wharf and Chambers Wharves: 1937 (Image 322762 © PLA Collection/Museum of London)

22.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination (Figure 22.9). This may in turn affect construction workers and adjacent premises. The previous use of the site as a wharf could have contaminated the site. Previous ground investigation indicates that the site is not grossly contaminated although some contamination was identified in the underlying soil. No likely significant effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

22.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the water (commonly termed a 'pathway') is created, resulting in the mobilisation of pollution. Groundwater resources may also be affected as a result of the removal of substantial volumes of water from the ground during construction. At the Chambers Wharf site the geology is such that the below ground structures would be at a depth where groundwater would be present. Due to the geology of the site and the past land use the removal of groundwater at the site would be limited through the implementation of special construction techniques such as removing water from within the shaft as it is built, rather than from outside it. Given these measures, no significant effects on groundwater resources or quality are likely to occur.

Figure 22.9 Ordnance Survey 1:2500 mile map of 1947–72 (not to scale)



22.3.17 As with groundwater, surface water quality can also be affected by when pathways for pollutants are created. At this site there is a direct pathway for pollutants to be discharged to the River Thames due to the location of part of the construction area within the river channel. A number of control measures would be applied to prevent contaminated waters from draining straight into the river. Surface water from the site would either go to existing drains or be collected on site in tanks that would allow the pollutants to separate from the water before it is released into drains whilst groundwater from dewatering would be treated prior to release. Based on the application of these measures, no significant effects on surface water would occur.

22.3.18 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal and river-sourced flooding and a low risk of surface water, groundwater and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, the cofferdam would be constructed in the foreshore to the same height as the existing flood defence and the flood risk assessment for his site has found that there would be no change in flood risk as a result of construction works. Therefore no significant effects are predicted in respect of flood risk

22.3.19 The construction of the cofferdam in the foreshore of the River Thames at this location would lead to some changes in the flow of water in the river, which may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with appropriate protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

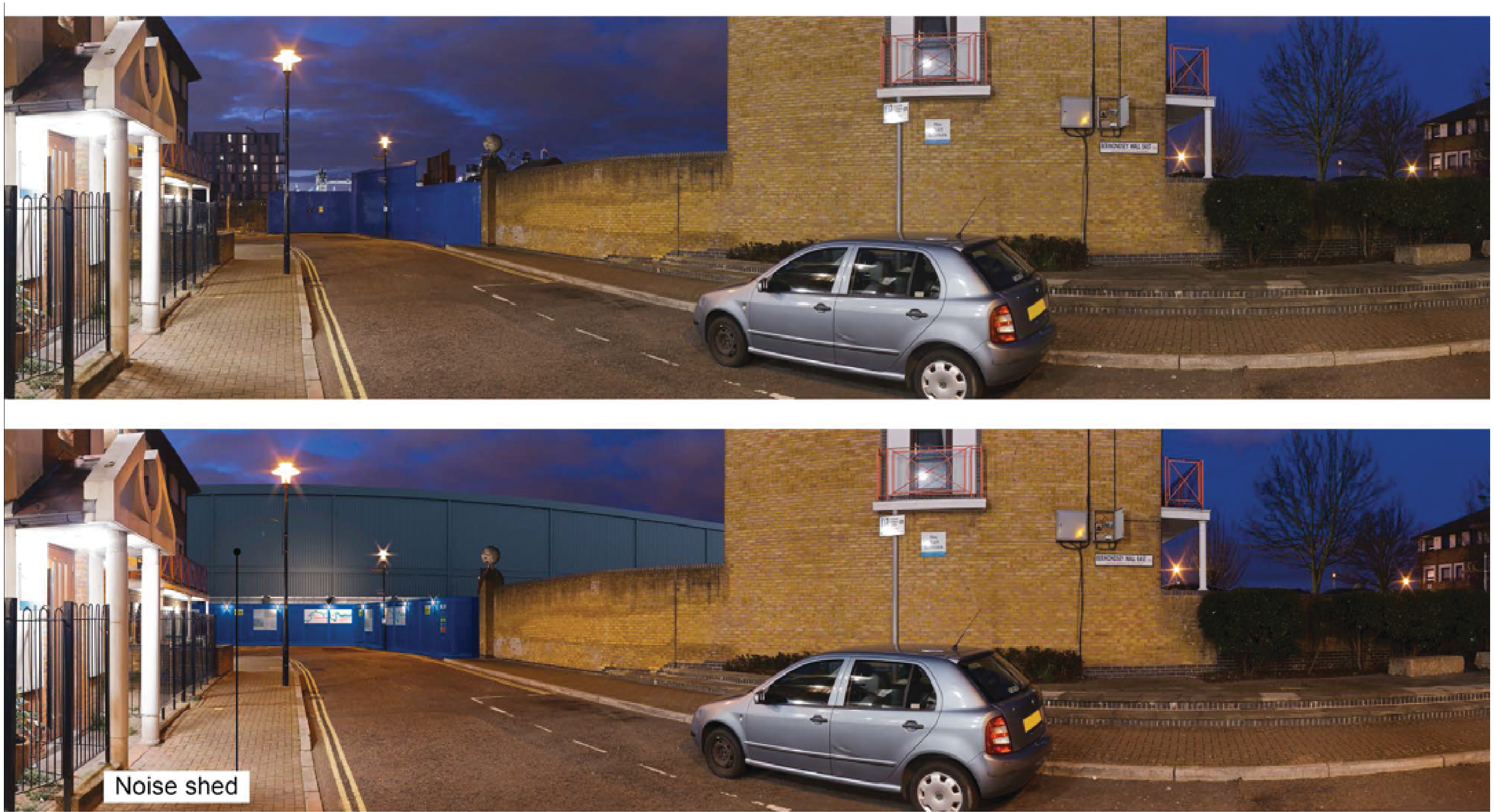
22.3.20 The River Thames provides an important habitat for river ecology. Due to the temporary loss of foreshore habitat associated with the in-river work, there would be a significant adverse effect on river based ecology. Disturbance of habitats and species due to barge movements would be over a limited area and would not be significant.

22.3.21 The presence of the cofferdam in the river would lead to some changes in the flow of water in the river. This could affect the speed of flow and consequently could change the area over which sediments are deposited. Such localised changes are not predicted to result in any significant effects on aquatic ecology.

22.3.22 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be put in place, including noise screening and avoiding direct lighting of the river. No significant adverse effects are therefore predicted. Such controls would also ensure there are no significant effects on land based species such as bats and wintering birds.

22.3.23 No other developments are planned nearby during the same time frame that would interact with the construction of the project at the site and so no significant cumulative effects have been identified.

Figure 22.10 Photo of existing site and photo real visualisation with noise enclosure during construction



Effects during operation

22.3.24 The operation of the Chambers Wharf site would include three ventilation columns of four to eight metres each. Air treatment filters would also be installed in an underground chamber to remove odour prior to release from the ventilation columns. The height of the ventilation columns would allow the elevated release of expelled air and therefore there would be no significant effect from odour.

22.3.25 Noise and vibration from operational plant, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design; therefore there would be no significant noise effect from this source. During maintenance visits a very low numbers of vehicles would be required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

22.3.26 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, access to the site for larger equipment such as cranes would result in occasional temporary delays and temporary suspension of parking. This relatively minor operational activity would not lead to significant effects on transport.

22.3.27 The operational structures would form a barely perceptible part of the overall townscape setting and views. All townscape character areas would experience improvement due to removal of the existing jetty and derelict structures. These effects would however not be significant as part of the wider setting of the character areas. Two viewpoints (the residents view east on the corner of Flockton Street and Bermondsey Wall West and the recreational view from the Thames Path west next to Fountain Green Square) would experience significant improvements because of the clearance of the derelict structures on site. Effects on the remaining viewpoints would not be significant.

22.3.28 While there would be no significant effects on above ground historic assets, the improvements would generally enhance the views from the conservation areas and the setting of the St Saviour’s Dock Conservation Area would also improve. No significant effects on below ground historic assets would occur during operation.

22.3.29 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

22.3.30 There would be no sewer interception at this site and so there would also be no significant effects on surface water at this site. In addition, the removal of the existing jetty at this site would not have significant effects on surface water.

22.3.31 The fully built project would not alter the existing flood risk and the site would be defended by new flood defences. Therefore the operational flood risk effects would not be significant.

22.3.32 Aside from the interaction of one development and the Chambers Wharf site on groundwater, which do not lead to significant effects, no other developments are planned nearby that would interact with the construction of the project at the site and so no significant cumulative effects have been identified.

22.3.33 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Socio-economic effects have not been assessed as the project would not affect the provision of public amenity space or the Thames Path.

c. A number of design measures would be included to prevent any contamination related to the operation of the main tunnel. The finishing of the areas around the operational structures with hard standing would prevent any future site users coming into contact with any contaminants retained below ground, and so operational land quality effects have not been assessed.

d. Operational effects for river based ecology for the Chambers Wharf site have not been assessed as this site would not directly intercept existing sewage spills or have any permanent in-river works.

e. Given the limited area taken up by the operational site, the infrequent maintenance requirements and the fact that the design would involve no operational lighting aside from a low level light to allow safe access to the kiosk for maintenance, land based ecology has not been assessed.

22.4 Further information

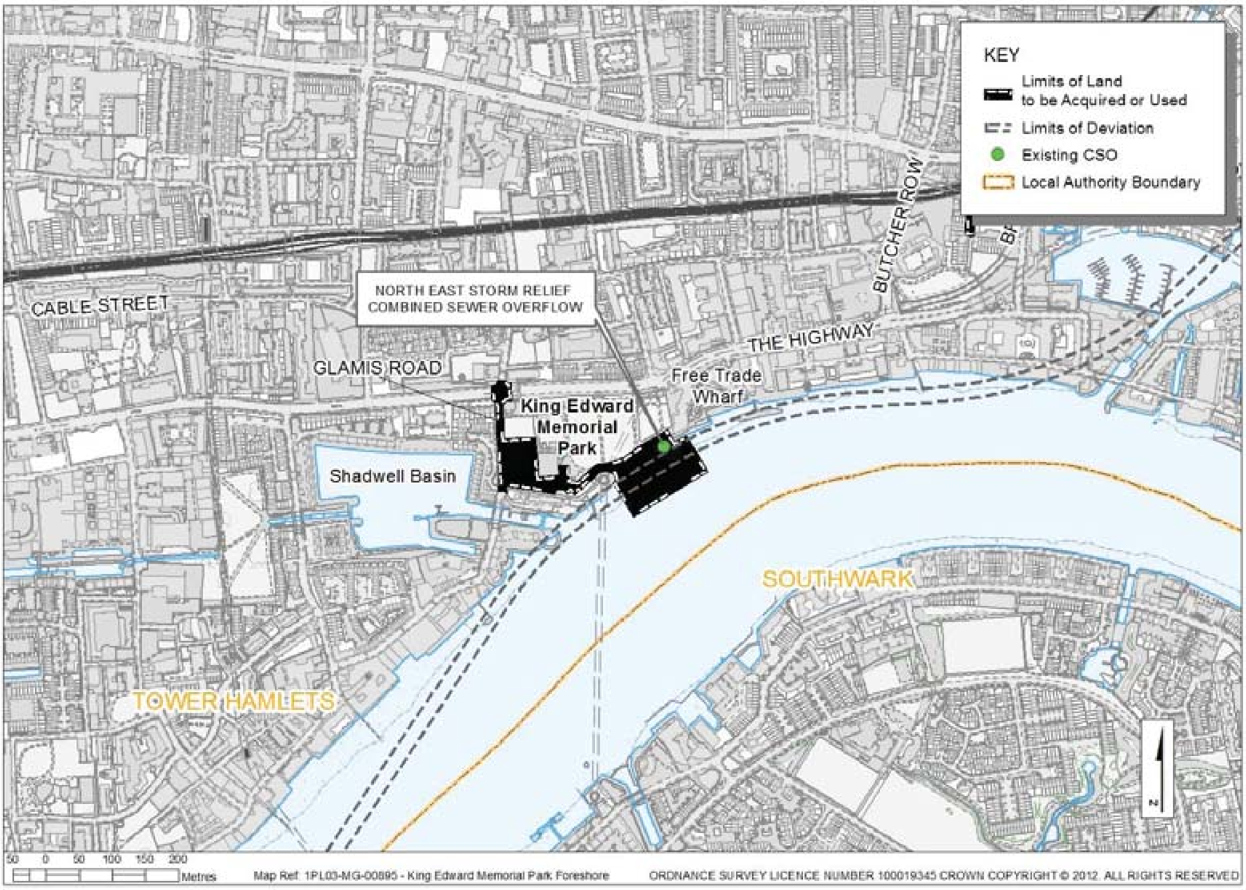
22.4.1 Further information regarding the assessment of the Chambers Wharf site can be found in Volume 20 of the *Environmental Statement*.

23 King Edward Memorial Park Foreshore

23.1 Existing site context

23.1.1 The King Edward Memorial Park Foreshore site is located within the London Borough of Tower Hamlets and is situated on the northern bank of the River Thames.

Figure 23.1[1] Location of proposed King Edward Memorial Park Foreshore site

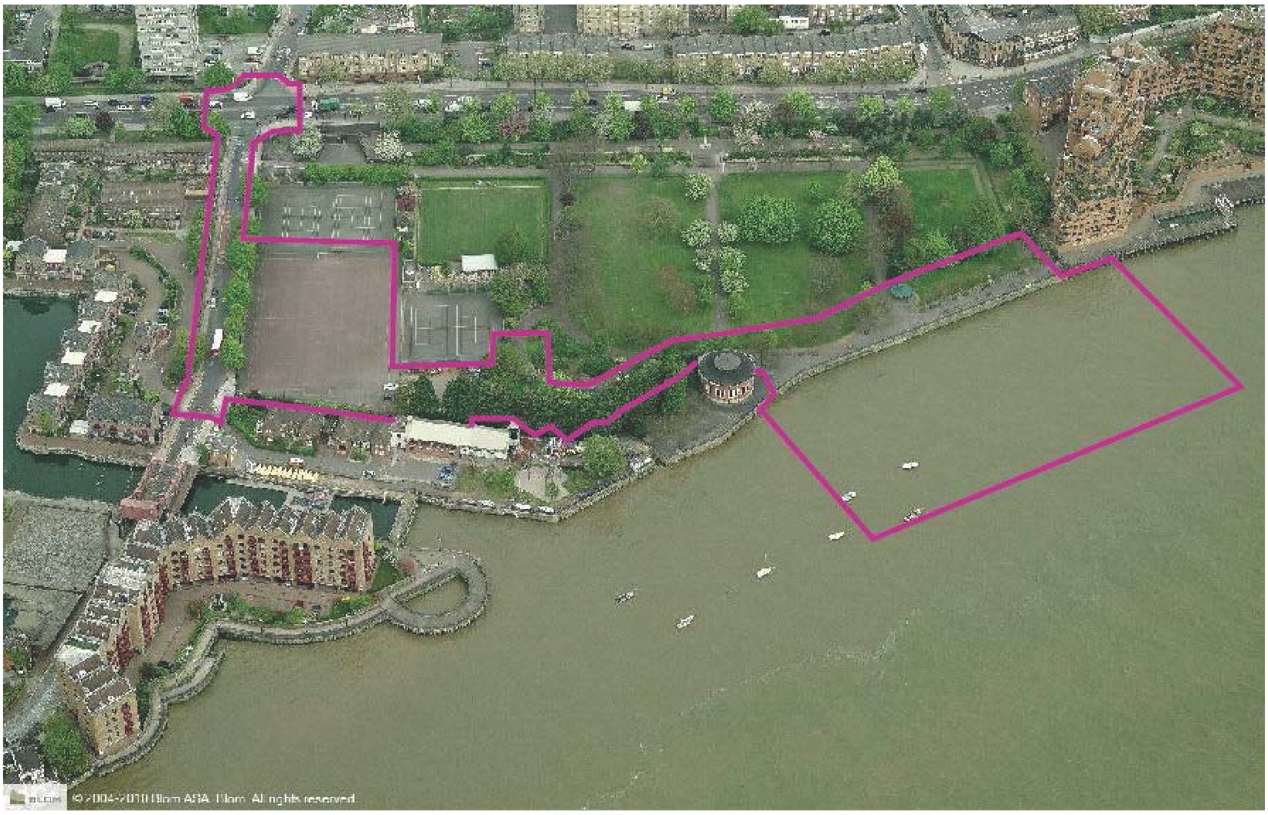


23.1.2 The site is bounded to the north by the retained areas of King Edward Memorial Park, with The Highway (A1203) further to the north beyond this. A 20th Century block of residential flats known as Free Trade Wharf is adjacent to the park to the northeast. The River Thames channel forms the southern boundary of the site. To the southwest of the site is Shadwell Basin Outdoor Activity Centre. The western edge of Glamis Road forms the western boundary of the site. Figure 23.1 to Figure 23.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

23.1.3 The site comprises predominantly River Thames foreshore and sub-tidal areas but also includes an area of the adjacent King Edward Memorial Park including some amenity grassland areas, hardstanding areas, a children's playground and maintenance buildings.

Figure 23.2 Aerial view of existing site



23.1.4 There are two existing vehicle accesses to the park from Glamis Road and a further four pedestrian accesses at various points around the perimeter of the park.

23.1.5 An air quality management designation has been made by the London Borough of Tower Hamlets, which covers the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

23.1.6 The foreshore part of the site lies within the River Thames and Tidal Tributaries Site of Importance for Nature Conservation. The site is also situated immediately adjacent to Shadwell Basin Site of Importance for Nature Conservation.

23.1.7 There are no listed buildings within the site. The Thames (Rotherhithe) Tunnel Air Shaft is Grade II listed and lies adjacent to the southern edge of the site. A Grade II listed slipway lies approximately 40m to the south of the site. The site, including the foreshore area, lies within the Wapping Wall Conservation Area.

23.1.8 There are no other environmental designations on or adjacent to the site.

Figure 23.3 King Edward Memorial Park Foreshore - site context

View from river of existing sewer discharge point

Within King Edward Memorial Park

Signage to Thames Path

Children's playground

23.2 Proposed development

23.2.1 The purpose of this 2 hectare site would be to intercept the North East Storm Relief combined sewer overflow, which currently discharges untreated sewage into the River Thames on average 31 times each year, at a total volume of 782,000 cubic metres. This is equivalent to approximately 313 Olympic swimming pools.

23.2.2 Once the existing sewer is intercepted and with flows diverted into the proposed main tunnel, there would be approximately four discharges of untreated sewage per year into the River Thames from this combined sewer overflow.

23.2.3 Flows would be transferred from the relatively shallow depth of the existing sewers to the deeper level of the main tunnel via a drop shaft. This shaft, approximately 60 metres deep with an internal diameter of approximately 20 metres, would be constructed in a new area of reclaimed land in front of the existing river wall adjacent to King Edward Memorial Park.

23.2.4 Construction at the King Edward Memorial Park Foreshore site is assumed to start in 2016 and be completed by 2020.

23.2.5 Prior to commencement of the main works, the children's playground would be relocated to a new site within the park. In addition, the sports area adjacent to Glamis Road would be reconfigured to facilitate construction of an access road to the main work site on the foreshore. The park bandstand and memorial benches would also be relocated subject to agreement with the London Borough of Tower Hamlets.

23.2.6 A temporary area of reclaimed land, called a cofferdam, would be constructed to enable a work site to be established in the River Thames to enable the construction of the shaft and other structures. The cofferdam would be retained by steel piles, or similar and built up to ensure that the site and surrounding area stay protected from flooding. The cofferdam would be filled to allow vehicles to access the working area from King Edward Memorial Park.

23.2.7 Material used to fill in the cofferdam, and also excavated material arising from construction of the shaft and other structures would be transported offsite by barges, minimising the number of lorry trips to and from the site. Road would be used when river transport is unavailable or unsuitable for the material being transported.

23.2.8 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

23.2.9 During construction, vehicles would access the site from a new access point constructed on Glamis Road. The site access road would traverse the park along its southern boundary to reach the cofferdam within the foreshore. A controlled pedestrian crossing would be provided along the access road to allow both park and Thames Path users to safely cross the road. This crossing would link the park foreshore area with the northern part of the park. The average peak daily number of lorry trips at this site would be 41 and the average peak daily number of barges would be two.

23.2.10 At an early stage in design, a new access from the Highway, immediately to the west of Freetrade Wharf was suggested although this was modified to the proposed location in response to stakeholder comments.

23.2.11 The plan below (Figure 23.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

23.2.12 To help explain this information, the schematic diagram below (Figure 23.5) illustrates the layout of where the structures may be located within these zones.

23.2.13 A new area of land on the foreshore would incorporate the below-ground engineering structures that connect the sewer into the tunnel. This area would be reinstated to form an area of new public realm and would form part of an extended King Edward Memorial Park. The area would be landscaped to reinforce the character of the park by planting large tree species, where possible, to quickly integrate the new area into the existing park. Landscaping would also include areas of hardstanding sufficient for access by operation and maintenance vehicles to the works.

23.2.14 While most of the structures would be underground, two 5 to 8 metre high ventilation columns and a smaller diameter 6 metre high ventilation column, needed for ventilation of the shaft and interception structures, would be located on the new area on the foreshore.

23.2.15 The height of the three new ventilation columns in combination with below ground filters, would control odour and minimise any effect on users of the park and on surrounding residents. These are shown in an illustrative above ground plan in Figure 23.6.

23.2.16 An electrical and control kiosk, approximately 3 metres high would be located near the boundary wall on the east side of the park. In addition, a small local push-button control pillar would be located on the new area of land on the foreshore to allow Thames Water to safely operate below-ground equipment.

23.2.17 No operational lighting would be provided, except for a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

23.2.18 Once operational, routine inspections would be made to the site every three to six months and major maintenance work carried out every ten years. Vehicle access to the site would be from a new permanent access route constructed from Glamis Road through the southern part of King Edward Memorial Park along the approximate alignment of the construction access route. This would be landscaped into the surrounding park area and would be available for public use.

Figure 23.4 Proposed development at King Edward Memorial Park Foreshore site

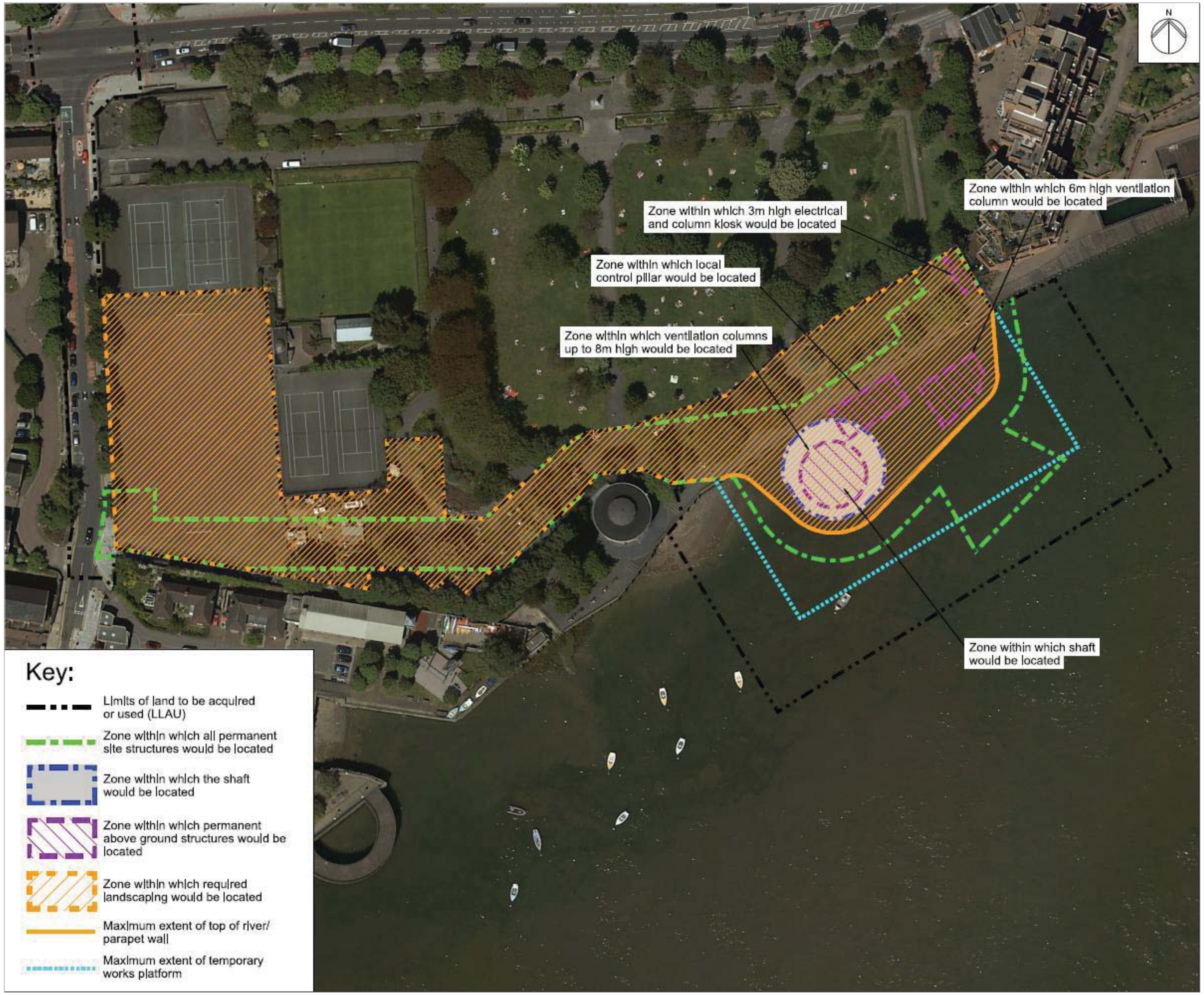


Figure 23.5 Schematic layout at King Edward Memorial Park Foreshore site

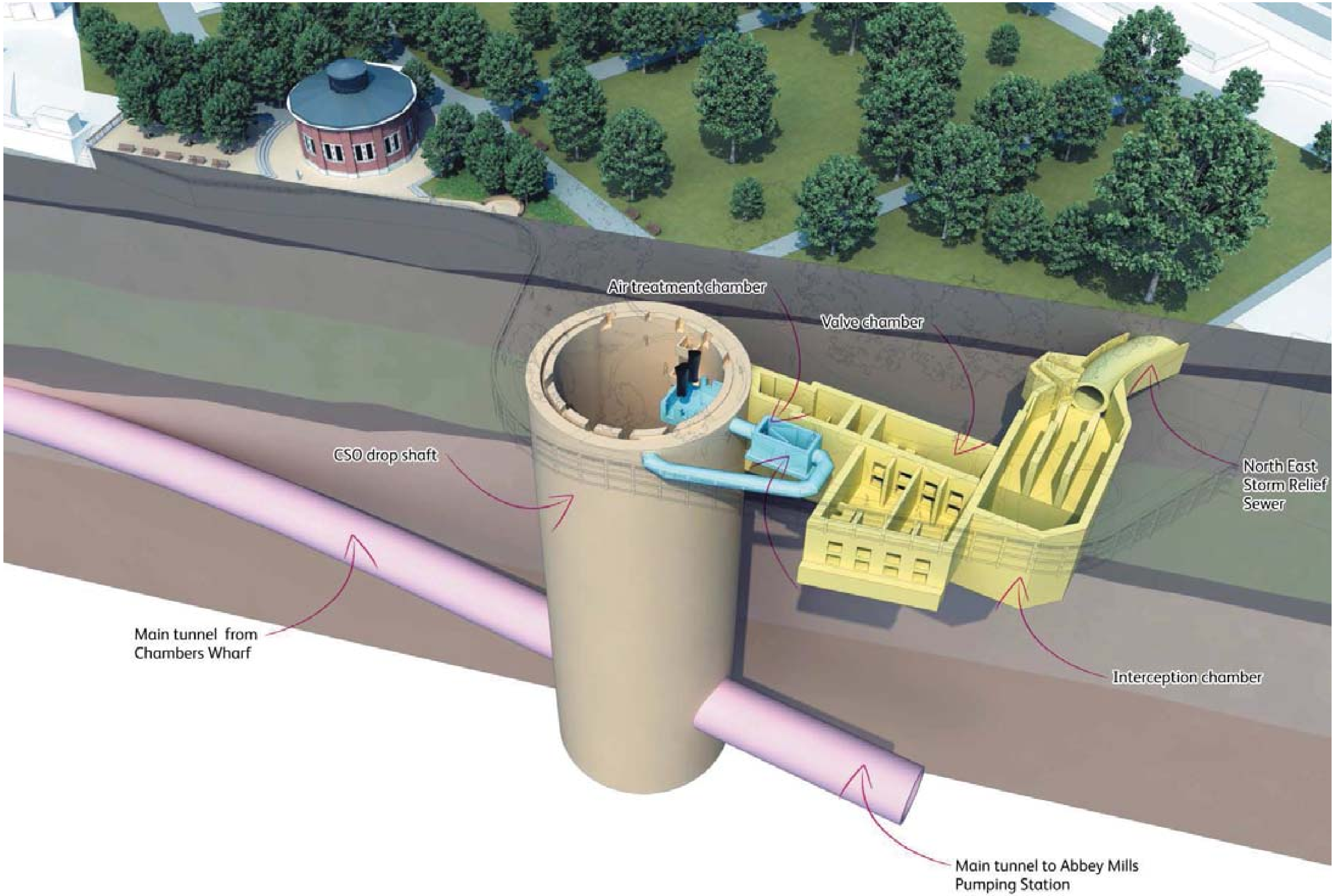


Figure 23.6 King Edward Memorial Park Foreshore site – illustrative aerial view

23.3 Effects of the proposed development at King Edward Memorial Park Foreshore on the environment

Introduction

23.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

23.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of the Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

23.3.3 The following section describes the likely significant effects (both beneficial and adverse) arising from the proposed development at the King Edward Memorial Park Foreshore site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the main tunnel is built and operational. The full details for each topic are contained in Volume 21 of the *Environmental Statement*.

Effects during construction

23.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles and tug boats (for river barges) that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties. Pollutant levels are currently high across the London Borough of Tower Hamlets. However, based on computer modelling it is predicted that pollutants associated with construction works would not result in significant effects on nearby sensitive properties. This is due to the small increase in pollutant concentrations predicted.

23.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

23.3.6 Noise could arise from construction activities including the movement of tug boats pulling river barges, construction traffic on roads outside the site and noise from equipment used on site. No significant noise effects from construction traffic (either road-based or river-based) are expected given the small predicted changes in traffic noise levels. In terms of noise effects from construction plant, the presence of site hoarding around the site would help reduce noise, however significant adverse noise effects from construction works on site are predicted at Pier Head Preparatory School. It is not possible to further reduce the noise effects through on site controls. However, the school may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme*.

23.3.7 Significant adverse effects are also predicted on residents of Free Trade Wharf South, a ten storey residential block close to the site. The affected residents of Free Trade Wharf South may be eligible to apply for noise insulation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy,* which if accepted, would reduce the effects to not significant.

23.3.8 Vibration related to construction activity can affect nearby properties and their inhabitants. Significant adverse vibration effects have been identified on the inhabitants of Free Trade Wharf South. These vibration effects would be due to piling that would be undertaken for the cofferdam construction. It may be possible to reduce the vibration effects by using low vibration piling methods. If ground conditions at the site are such that these methods could be implemented, effects would not be significant. However, the specific ground conditions encountered would not be known until piling is underway. If ground conditions do not allow these methods to be implemented then the residents of Free Trade Wharf South may be eligible for compensation for vibration effects under the *Thames Tideway Tunnel compensation programme*.

23.3.9 In terms of townscape, significant adverse effects are predicted at this site. This is largely due to the high existing levels of tranquillity within the park being altered by the introduction of construction vehicles, plant equipment as well as the high levels of construction activity.

23.3.10 People using the area around the site, including residents and those involved in recreation, may also be subject to visual effects, that is effects on their experience of views. Significant adverse effects are predicted on residential and recreational viewpoints during construction. This is largely due to the visibility into the site and the presence of construction plant. Significant adverse effects are likely within Free Trade Wharf and from the Thames Path. Further away from the site and location of the works, effects would not be significant.

Figure 23.7 Thames River Path

Figure 23.8 View from park looking towards existing site (top photograph) and of site with construction works in place (lower photomontage

23.3.11 Consideration of the amenity of local residents, businesses and users on the Thames Path and park is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. Significant adverse effects have been identified on users of the park, the amenity of residents and the amenity of users of the Pier Head Preparatory School. The residents and the school may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme*.

23.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of road users, pedestrians and cyclists would ensure that no significant transport effects occur at this site.

23.3.13 A study of historical maps, previous archaeological records and research into local history has been undertaken to build up a picture of the possible below ground remains (Figure 23.9). Construction work on site would involve changes to both above ground features as well as the environment below ground.

Figure 23.9 Thames Riverscape showing the King Edward VII Memorial Park, Shadwell 1937 (Image 321990 © PLA collection/Museum of London)

23.3.14 Information gathering has revealed that there is some possibility of below ground heritage assets being present, such as prehistoric and medieval remains, although these may have been removed by earlier construction at the site. There is greater potential for post-medieval remains. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

23.3.15 Significant adverse effects are predicted on the listed Rotherhithe Tunnel Air Shaft (Figure 23.10) and Wapping Wall Conservation Area due to the change to their historic character and setting caused by the construction works.

Figure 23.10 View northwards towards Grade II Rotherhithe tunnel Air Shaft

23.3.16 Significant adverse effects are also predicted on the character of the King Edward Memorial Park. This is largely due to removal of a number of trees in the southern sections of the park and the temporary removal of a bandstand and benches as well as the detraction from views within and to the park.

23.3.17 Below ground works could give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. The majority of the site is within the foreshore, which has not been subject to contaminative past uses. The land based part of the site has been occupied by potentially contaminative land uses during the late 19th Century and early 20th Century, namely:

refrigeration works, wharves and a dust yard.   No significant effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

23.3.18 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the groundwater (commonly termed a ‘pathway’) is created. Groundwater resources may also be affected as a result of the removal of substantial volumes of water from the ground during construction. At the King Edward Memorial Park Foreshore site the geology is such that the below ground structures would be at a depth where groundwater would be present. Due to the geology of the site the removal of groundwater at the site would be limited through the implementation of special construction techniques such as removing water from within the shaft as it is built, rather than from outside it. Given these measures, no significant effects on groundwater (both in terms of quality and resources) are likely to occur.

23.3.19 As with groundwater, surface water quality can also be affected by when pathways for pollutants are created. At this a route for pollutants to enter the water may arise during the construction of the temporary cofferdam within the River Thames. This is because pollutants could be disturbed by excavation in the foreshore. Another route for pollutants could be from substances used in construction (for example, oils) draining into the river from the site. However, a number of control measures would be applied to prevent pollutants getting into the river in this way. Pollutants would either go into existing drains or be collected on site. Based on the application of these measures, no significant effects on surface water would occur.

23.3.20 The construction of the cofferdam in the foreshore of the River Thames at this location would lead to some changes in the flow of water in the river, which may result in the local erosion of the river bed (a process known as scour) or the silting up of more sheltered areas. This would be monitored during construction with appropriate protective measures in place for any affected structures and dredging if required. No significant effects are predicted in relation to changes in the river bed.

23.3.21 Flooding may occur from various sources, for example tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, fluvial, surface water and sewer flooding at this location. The cofferdam would be constructed in the foreshore to the same height as the existing flood defence and the flood risk assessment for this site has found that there would be no change in flood risk as a result of construction works. Therefore there would be no significant effect in respect of flood risk.

23.3.22 The River Thames provides an important habitat for river ecology. As most of the construction works at the King Edward Memorial Park Foreshore site would take place within the river, this may have an effect on this ecology.

23.3.23 The total temporary landtake from habitats within the river from construction of the cofferdam would be a small percentage of the total area of the River Thames and its tributaries, which are designated for their nature conservation value. Given this, no significant effects due to landtake are predicted on river habitats and associated species of plants and animals. There is also likely to be some disturbance of habitats and species due to barge movements. However, this would be over a limited area, and so no significant effects are predicted.

23.3.24 As described above, the presence of the cofferdam in the river would lead to some changes in the flow of water in the river. While this could affect the speed of flow and consequently could change the area over which sediments are deposited or existing sediments eroded, such localised changes are not likely to be significant.

23.3.25 Noise, vibration and lighting have the potential to disturb marine mammals and fish during construction. However, control measures would be put in place, including noise screening and minimising light spillage. No significant adverse effects are therefore predicted. These control measures would also prevent significant adverse effects on land based ecology such as wintering birds and bats, for which the River Thames provides habitat.

Figure 23.11 Information on local wildlife

23.3.26 No other developments are planned nearby during the same timeframe that would interact with the construction work at the King Edward

Memorial Park Foreshore site and so no significant cumulative effects have been identified.

Effects during operation

23.3.27 The operational site would include an underground air treatment chamber connected to three ventilation columns whilst below-ground air treatment chamber would include filters that would remove any odours from the air to be released. The height of the ventilation columns (5 to 8 metres in height) would allow the elevated release of expelled air. This would ensure that there would be no significant effect from odour.

23.3.28 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example plant within the electrical and control kiosk) would be minimised by sound insulation. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

23.3.29 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. Tunnel maintenance, which would occur approximately once every ten years, would require larger equipment such as cranes. Space to locate the cranes may require the temporary diversion of the Thames Path. The ten yearly maintenance visits may also lead to some temporary, short-term delay to users of the local road network. However, these operational activities would not lead to significant effects.

23.3.30 Likely significant beneficial effects on the character and the townscape of the site are predicted. This is due to the change in the character and setting of the area as a result of the creation of a new area of high quality public realm. There would also be significant beneficial effects on a number of recreational viewpoints.

23.3.31 In terms of socio-economics, there would be significant beneficial effects due to the increase in the area of public open space and landscaping changes at the park.

23.3.32 The design of the permanent works would also enhance the views out of the Wapping Wall Conservation Area across the River Thames resulting in significant beneficial historic environment effects.

Figure 23.12 Existing site and photomontage with permanent works in place

23.3.33 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

23.3.34 The proposed permanent structures at this site in the river have the potential to affect the movement of water, and consequently deposition and erosion of sediments. However, protective measures for any affected structures would be included in the operational development. No significant adverse effects are therefore predicted.

23.3.35 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected. It would remove almost all the discharges, resulting in significant improvements to water quality.

23.3.36 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology. Sewage in the river leads to high levels of bacteria which remove oxygen from the water, leading to the death of fish. Reduced levels of sewage entering the river would mean this would happen far less often, which would therefore have a significant beneficial effect on fish populations. It is also likely that there would be significant beneficial effects from an increase in pollution sensitive fish species and an improvement in the quality of foraging habitat for fish.

23.3.37 The permanent loss of foreshore habitat would have a significant adverse effect on river habitats. To compensate for this, and other sites where permanent works in the river are proposed, a series of compensation measures have been developed. These include schemes to improve access to or creation of habitats elsewhere along the River Thames and its tidal tributaries.

23.3.38 The fully built project would also not alter the existing flood risk and the site including the new operational structures on the foreshore would be defended by new flood defences. Therefore the operational flood risk effects would not be significant.

23.3.39 The assessments have considered other developments that are planned nearby that would interact with the operation of the development site. No likely significant cumulative effects have been identified.

23.3.40 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no likely significant effects in terms of contaminated land and therefore this has not been assessed.

c. Operational activities are limited at this site and not likely to lead to likely significant operational effects on land-based ecology and these effects were not assessed.

23.4 Further information

23.4.1 Further information regarding the assessment of the King Edward Memorial Park Foreshore site can be found in Volume 21 of the *Environmental Statement*.

24 Earl Pumping Station

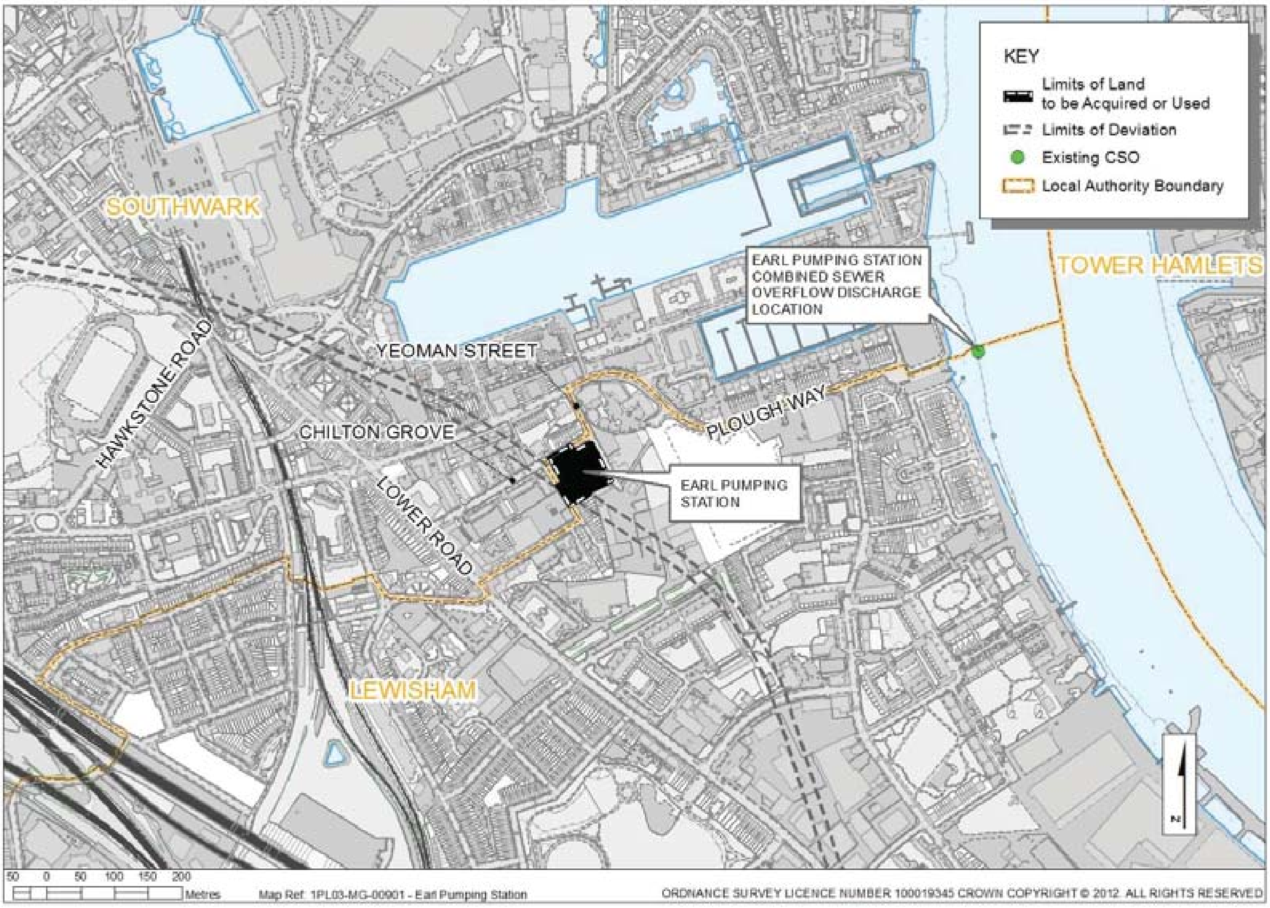
24.1 Existing site context

24.1.1 Earl Pumping Station, which forms the northern part of the site, is an existing Thames Water pumping station site located within the London Borough of Lewisham.

24.1.2 Land to the south of the pumping station, which forms the southern part of the site, comprises a depot, weighbridge and offices. A small section of the highway works, in the road to the north of the pumping station is within the London Borough of Southwark.

24.1.3 Adjacent to the southern boundary of the site there are occupied commercial/industrial units and a row of two-storey terraced houses with gardens; the northernmost dwelling in the terrace lying adjacent to the site boundary. Immediately west of the site on Croft Street is a six storey block of flats and a large industrial unit.

Figure 24.1[1] Location of proposed Earl Pumping Station site



[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Figure 24.2 Aerial view of existing site

24.1.4 The surrounding area is predominantly industrial to the south and east with housing to the west and north. Figure 24.1 to Figure 24.3 show the site and local context.

24.1.5 Existing access to the site is from Chilton Grove to the north and Yeoman Street to the east, via Plough Way and Lower Road (A200). The site lies inland approximately 600 metres west of the River Thames.

24.1.6 Air quality management designations have been made by the London Borough of Lewisham and the London Borough of Southwark. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

24.1.7 The site lies within the northern part of an archaeological priority area, which are designated by the planning authorities where archaeological finds are likely, and which extends from Deptford to include The Strand, Sayes Court, and the Royal Naval Dockyard. There are no other environmental designations on or adjacent to the site.

Figure 24.3 Earl Pumping Station – site context

View of Earl Pumping Station

Residential dwellings on Croft Street

View north along Yeoman Street

View east along Chilton Grove

24.2 Proposed development

24.2.1 The purpose of this 0.6 hectare site would be to intercept a sewer which currently discharges untreated sewage into the River Thames on average 26 times each year, at a total volume of 539,000 cubic metres. This is equivalent to approximately 216 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed main tunnel, there would be approximately four discharges of untreated sewage into the River Thames per year from this combined sewer overflow.

24.2.2 Construction at Earl Pumping Station is assumed to start in 2017 and be completed by 2021.

24.2.3 Flows would be transferred from the relatively shallow depth of the existing sewer to the deeper level of the main tunnel via a drop shaft and the Greenwich connection tunnel. The shaft would be approximately 51 metres deep with an internal diameter of approximately 17 metres and would be constructed to the south of the existing pumping station compound. The existing depot and industrial buildings on this land would be demolished in order to allow construction of the shaft and other structures.

24.2.4 To intercept the flow in the existing sewer, a chamber would be constructed on the sewer which is located at the northern end of the site between the main pumping station building and the smaller sewage pumping station located to the west. A culvert would be built to connect the interception chamber to the shaft in order to transfer the flows.

24.2.5 There would be environmental controls in place throughout the construction phase. This would include measures such as damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

24.2.6 During construction, vehicles would access the construction site from a new access point in Yeoman Street and leave the site via Croft Street. Two existing access points to the Thames Water Earl Pumping Station compound, one on Yeoman Street and the other on Chilton Grove, would also be used. As this site is inland, materials would be transported to and from the site by road, rather than by barge on the river. The average peak daily number of lorry trips at this site would be 34.

24.2.7 The plan below (Figure 24.4) shows the layout of the proposed development for which consent is sought. The plan shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

24.2.8 To help explain this information, the schematic diagram below (Figure 24.5) illustrates the layout of where the structures may be located within these zones.

24.2.9 Whilst most of the shaft is below ground, the top of the shaft would be about 5 metres above ground level and ventilation structures located on top of the shaft, reaching about 5 to 7 metres above ground level. Within the existing Thames Water Pumping Station compound, a new valve chamber would extend about 4 metres above ground level. In addition to these structures a 4.8 to 8 metre high ventilation column and two smaller diameter 6 metre high ventilation columns would also be needed for ventilation of the shaft and interception structures. The height of the ventilation columns, in combination with filters included in the design, would control odour and minimise any effect on surrounding residents. The above ground structures are illustrated in Figure 24.6.

24.2.10 Electrical and control equipment would be located within the existing pumping station building.

24.2.11 No new lighting would be provided, except for lighting to the raised surface of the shaft. Once operational there would be routine inspections to the site every three to six months and important maintenance work carried out every ten years. Access to the site would be from the two existing access gates on Chilton Grove and Yeoman Street together with a new vehicle access point on Croft Street.

Figure 24.4 Proposed development at the Earl Pumping Station site

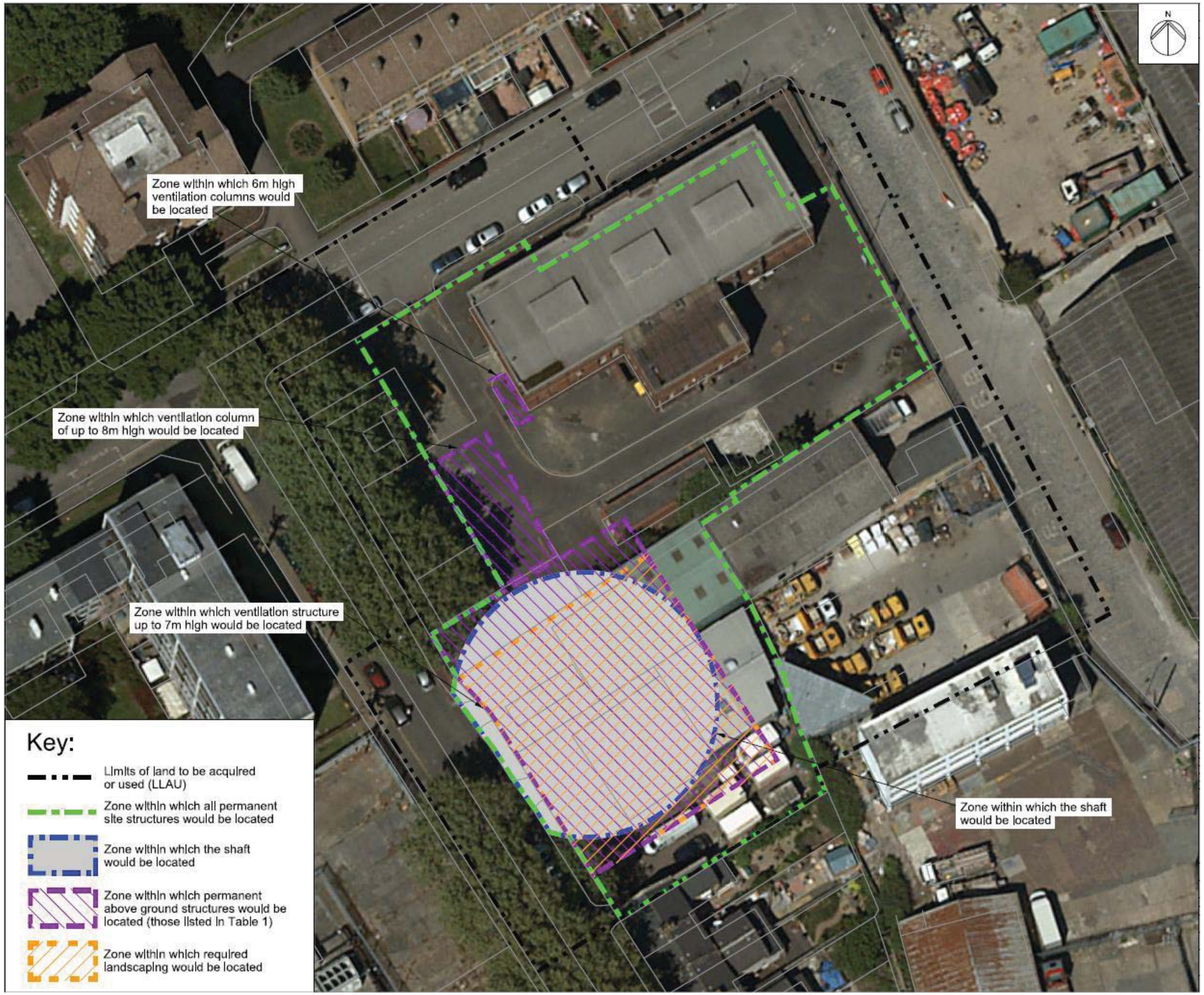


Figure 24.5 Schematic layout at Earl Pumping Station site

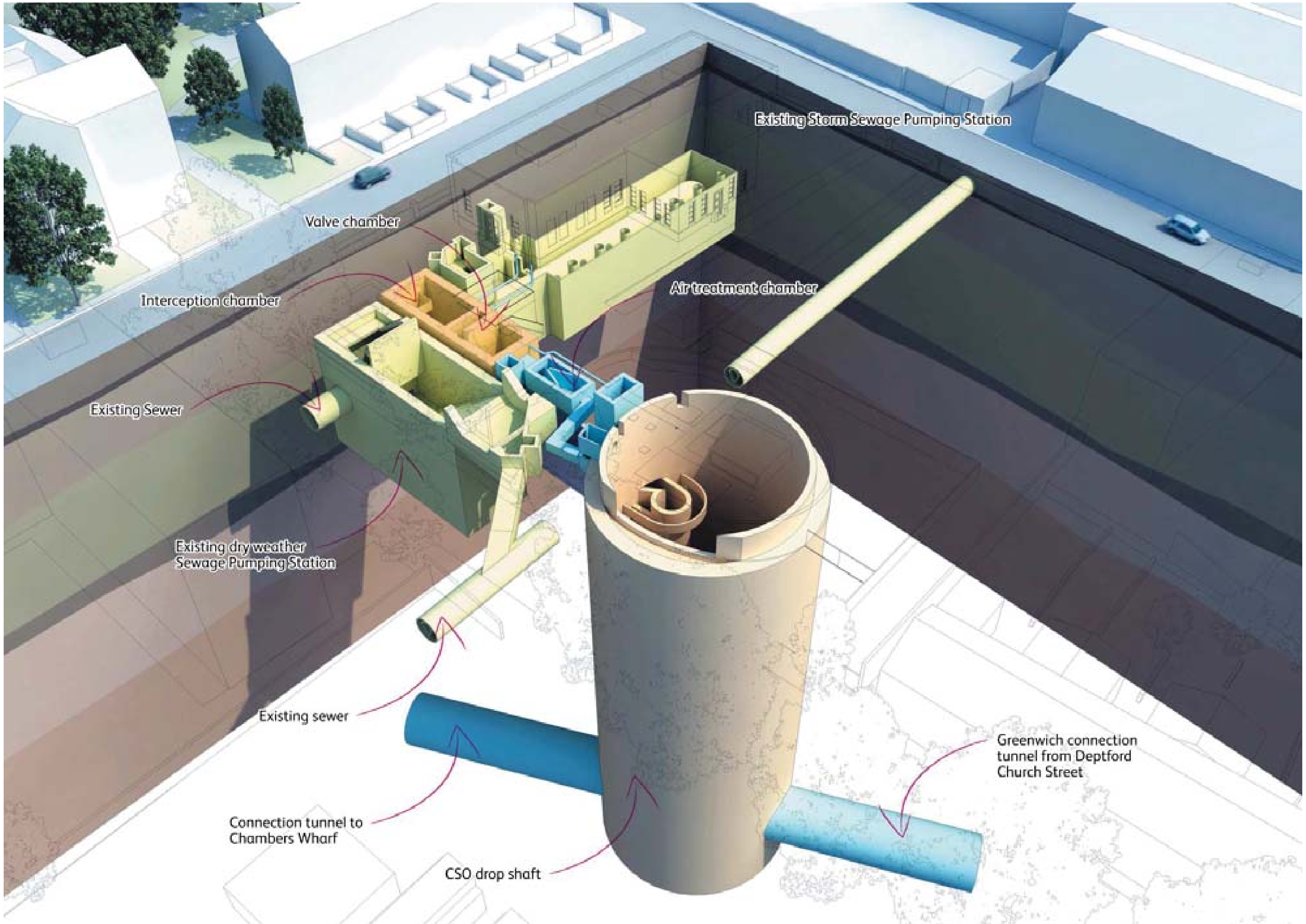
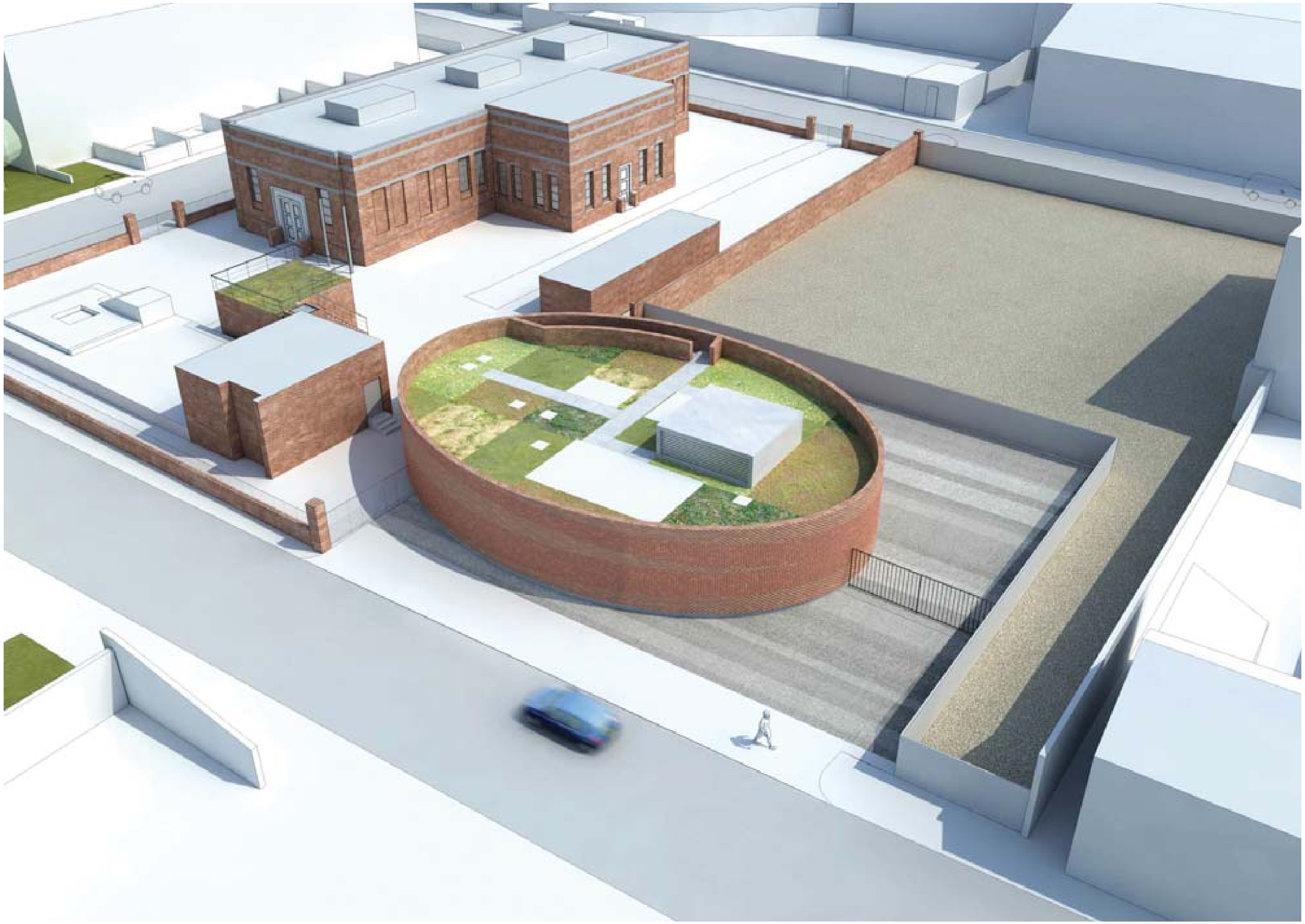


Figure 24.6 Earl Pumping Station site – illustrative aerial view



24.3 Effects of the proposed development at Earl Pumping Station on the environment

Introduction

24.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

24.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

24.3.3 The following section summarises the site effects (both beneficial and adverse) arising from the proposed development at the Earl Pumping Station site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the development is built and operational. The full details for each topic are contained in Volume 22 of the *Environmental Statement.*

Effects during construction

24.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties. Vehicle related pollutant levels are currently high in both the London Borough of Lewisham and the London Borough of Southwark. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on nearby properties. This is due to the small increase in pollutant concentrations predicted.

24.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust.

24.3.6 The soil on the Earl Pumping Station site is known to be contaminated with hydrocarbons, including a substance called naphthalene. Naphthalene is odorous and has a World Health Organisation guideline set to protect human health as it is a suspected carcinogen. The potential for naphthalene vapours to affect local residents has been modelled and the odour would be detectable at some properties for a small proportion of the year (approximately 22 hours in the modelled year). However, the concentrations of naphthalene would be considerably lower than the World Health Organisation guidelines. Based on the outcomes of the modelling work and with the appropriate controls in place there would be no significant effects associated with odour.

24.3.7 Noise could arise from construction activities including the movement of large vehicles and noise from equipment used on site. The extra vehicles associated with the construction would result in a small increase to future traffic levels however this would not result in a significant increase in noise.

24.3.8 The noise of construction activities, generated by construction plant and vehicles, would be controlled on site through measures such as barriers to noise between sources and local properties. However, during certain periods of construction, noise levels are anticipated to rise above the relevant standards at 1-39 and 108-136 Chilton Grove, 52-62 Croft Street and at Block J of the proposed Cannon Wharf development resulting in significant adverse noise effects. It is not possible to further reduce the noise effects through on site controls. However the owners of the properties that would be affected by noise may be eligible to apply for noise insulation through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*. Application of these measures would mean that there would be no significant noise effects. Where the noise level would not trigger the provision for noise insulation some of the properties may be eligible for compensation through the Thames *Tideway Tunnel compensation programme*. Where this is the case the noise effects would remain significant.

24.3.9 Vibration related to construction activity could affect nearby properties and their inhabitants. Predictions of vibration at Earl Pumping Station indicate that, although vibration levels would not reach a level which could cause structural damage, there is the potential for adverse comment from residents of 52-62 Croft Street (Figure 24.7 shows some of the terraced houses along Croft Street) and at the proposed Cannon Wharf Block J. It may be possible to reduce the vibration effects by using low vibration piling methods. If ground conditions at the Earl Pumping Station site are such that these methods could be implemented, effects would not be significant. However, the specific ground conditions encountered would not be known until piling is underway. If ground conditions do not allow these methods to be implemented then the residents that would be affected by vibration may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme.*

Figure 24.7 Existing view of residential properties along Croft Street

24.3.10 In terms of townscape, significant adverse effects around the site are likely due to the change in setting during construction phase from large plant and machinery. Similarly, significant adverse effects are predicted for a number of residential viewpoints adjacent to the site.

24.3.11 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. As significant noise, vibration and visual effects are anticipated, there would be significant adverse effects on the amenity of residents close to the site.

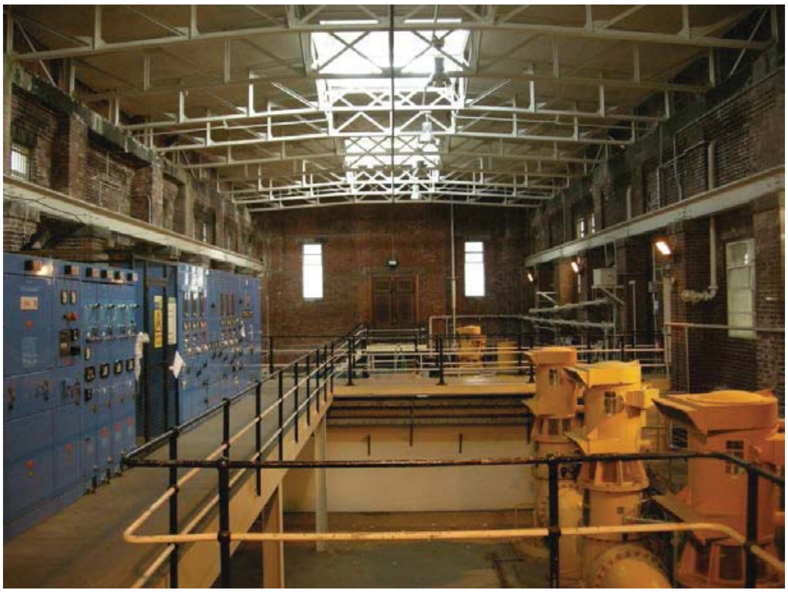
24.3.12 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that significant transport effects are minimised.

24.3.13 A study of historical maps, previous archaeological records and research into local history have been undertaken to built up a picture of the possible below ground remains. Construction work on site would involve changes to both above ground features as well as the environment below ground.

24.3.14 Information gathering has indicated that there is the potential for prehistoric archaeological assets to be present under the site. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted. .

24.3.15 Above ground historic environment features include the existing Earl Pumping Station Building (Figure 24.8) although there would not be significant effects on this.

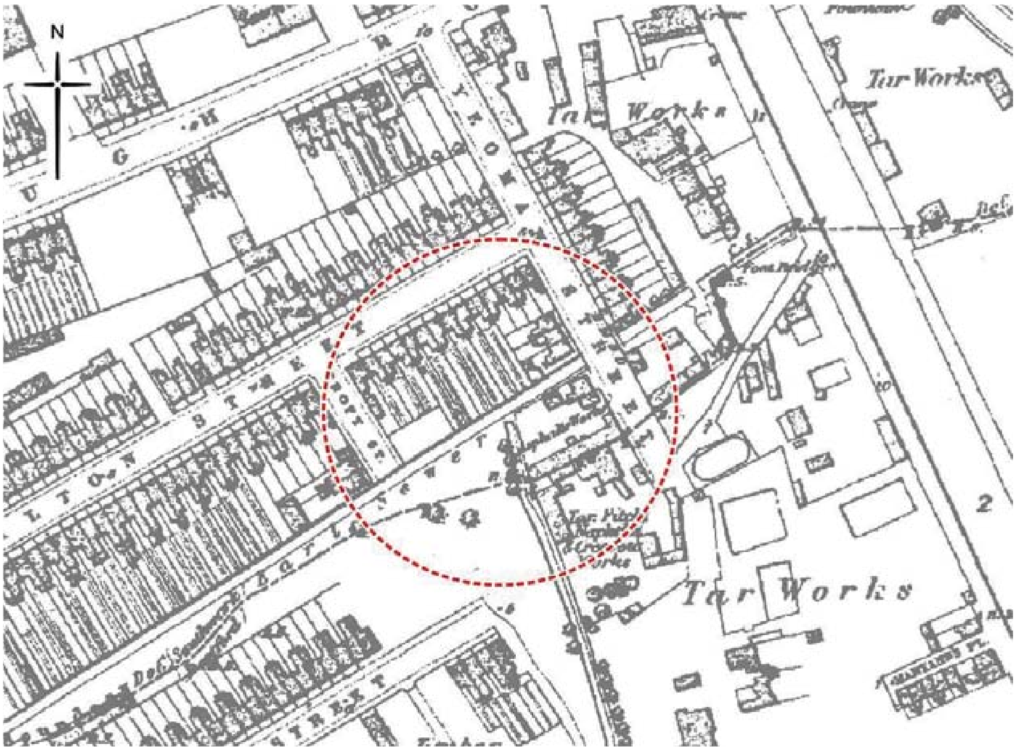
Figure 24.8 Interior of Earl Pumping Station



24.3.16 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past (Figure 24.9). This contamination has the potential to affect construction workers and adjacent premises. Part of the site was previous used as a tar, pitch and creosote works. Contamination related to this historical land use has been identified at the site. However, the application of appropriate construction measures would ensure that no significant effects are likely. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

24.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created. Groundwater resources may also be affected as a result of the removal of substantial volumes of water from the ground during construction. At the Earl Pumping Station site the geology is such that the below ground structures would be at a depth where groundwater would be present. Due to the geology of the site and the past land use the removal of groundwater at the site would be limited through the implementation of special construction techniques such as removing water from within the shaft as it is built, rather than from outside it. Given these measures, no significant effects on groundwater are likely to occur.

Figure 24.9 Ordnance Survey 1st edition 25”: mile map of 1862 (not to scale)



24.3.18 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. At the Earl Pumping Station site the most likely route for pollution to enter watercourses would be via the removal of contaminated groundwater and its subsequent disposal. A number of control measures would be applied to prevent substances from leaving the site and entering surrounding watercourses or waterbodies including the appropriate treatment of extracted groundwater. Treated water would either go to existing drains or, if appropriate treatment was not possible, polluted water would be collected and sent for licensed disposal. Based on the application of these measures, no significant effects on surface water would occur.

24.3.19 Flooding may occur from various sources for example tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The proposed development has the potential to change the level of risk associated with all sources of flooding. However, the finding of the flood risk assessment for the site is that there would be no change in flood risk during construction and there would be no significant effect in respect of flood risk

24.3.20 Construction effects would only occur for river based ecology where construction activities take place in-river. As this site is inland there would be no significant effects.

24.3.21 The Earl Pumping Station site including the adjacent industrial land is an area that is of limited value to land based ecology. During construction control measures would be in place to ensure there would be no significant adverse effects on ecology.

24.3.22 The construction of other developments in the vicinity of the Earl Pumping Station site during the same timeframe has been considered through a cumulative assessment for each of the topics. No additional construction effects are anticipated as a result of cumulative developments for ecology, air quality, water resources, traffic and transport.

24.3.23 Cumulative noise effects associated with the Yeoman Street and Cannon Wharf developments would result in an elevation in noise levels at properties close to the Earl Pumping Station site which could result in likely significant adverse effects at these properties. Construction activity associated with new developments would also result in significant adverse effects on five visual assessment views of the site. The residential amenity of local residents would also be affected by the same changes, resulting in elevated effects with the potential that some of these would be significant adverse.

Effects during operation

24.3.24 The operational site would include ventilation columns (one of 4-8m, and two 6m narrow ventilation columns) and a ventilation structure (5-7m adjacent to the shaft) whilst air treatment filters would also be installed to remove odour prior to release from the ventilation column. The height of the ventilation columns and the ventilation structure would allow the elevated release of expelled air to ensure there would be no significant effect from odour.

24.3.25 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, electrical and control plant) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground and a number of structures provide a barrier to noise and vibration, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

24.3.26 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term temporary parking restrictions on adjacent roads to allow safe access to the site. This relatively minor operational activity would not lead to significant effects.

24.3.27 The effects on townscape character areas and viewpoints have been assessed for the completed development at the Earl Pumping Station site and no significant effects are likely.

24.3.28 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

24.3.29 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

24.3.30 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected. This would result in significant benefits to water quality.

24.3.31 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology. Fish would benefit from the reduced pollution, leading to a general in increase in numbers and species diversity.

24.3.32 The assessments have considered other developments that are planned nearby that would interact with the operational development at the Earl Pumping Station site. The design at Earl Pumping Station is expected to have a significant beneficial effect on the views for the newly built development on Yeoman Street. No other significant cumulative effects have been identified for the operational phase.

24.3.33 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Socio-economic effects have not been assessed as the land surrounding the site is no longer designated as employment land and the use of this land would therefore not result in a reduction in designated employment land. There would be no significant amenity effects during operation.

c. Land quality effects have not been assessed for the operational development as once the construction phase has been completed the site would be finished such that any contamination retained below ground on site would not come into contact with any site operators or members of the public.

d. Operational activities would also have no effect on aspects of historical interest, below or above ground, and therefore effects on the historic environment during the operational phase were not assessed.

e. Given the limited value of the site for ecology and the infrequent maintenance requirements significant effects on land based ecology are not likely, and therefore were not assessed.

24.4 Further information

24.4.1 Further information regarding the assessment of the Earl Pumping Station site can be found in Volume 22 of the *Environmental Statement.*

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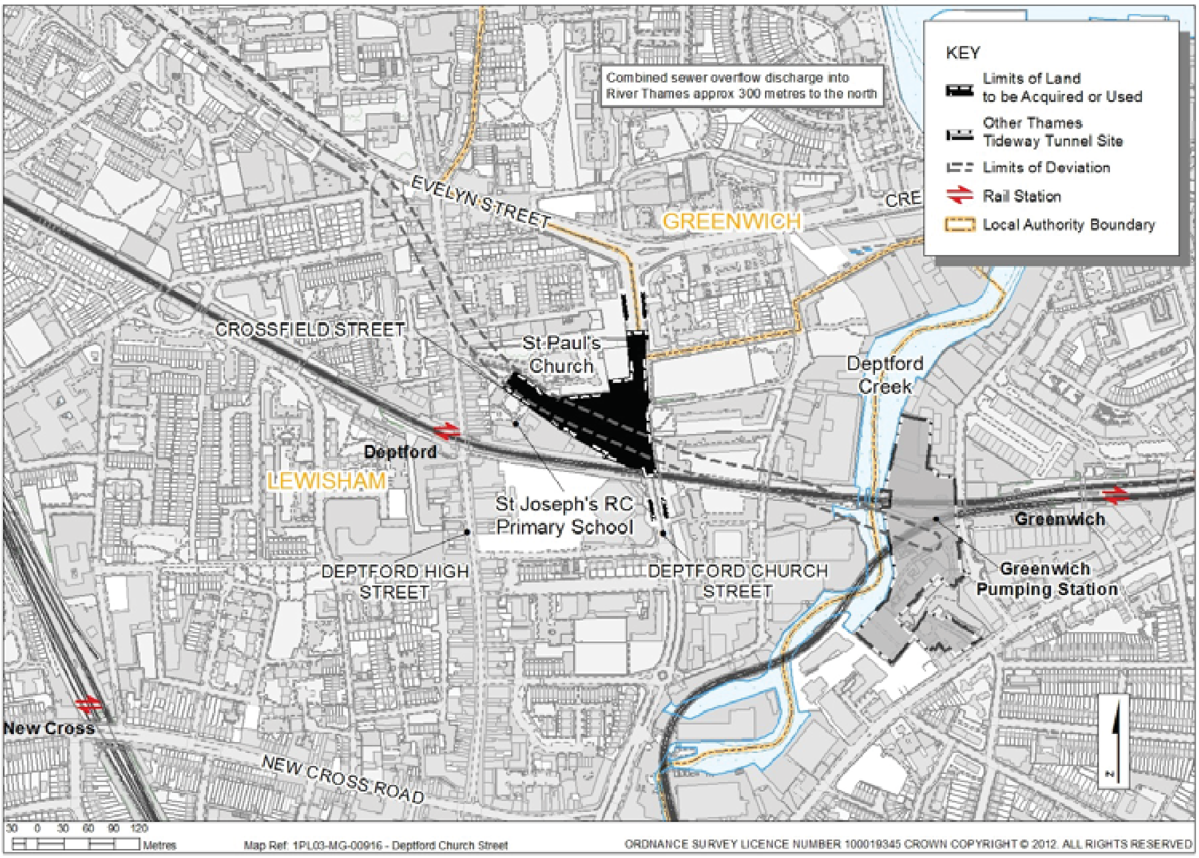
25 Deptford Church Street

25.1 Existing site context

25.1.1 Deptford Church Street site is located in the London Borough of Lewisham. It comprises a main site made up of existing public open space and four small highway works sites on Deptford Church Street.

25.1.2 The main site is triangular in shape bounded to the north by the Grade I listed St Paul's Church, to the east by Deptford Church Street (A2209), beyond which lies the Sue Godfrey Local Nature Reserve. St Joseph's Roman Catholic Primary School lies to the southwest of the site.

Figure 25.1[1] Location of proposed Deptford Church Street site

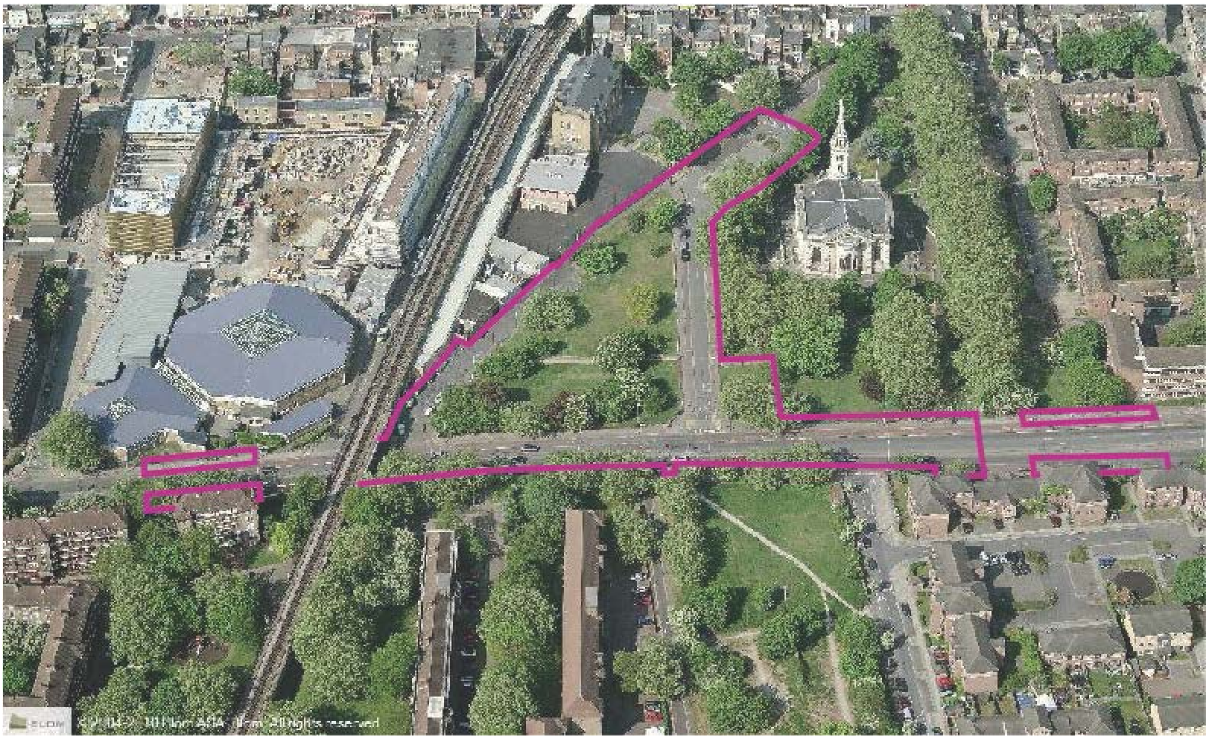


25.1.3 The nearest residences are to the east of the site across Deptford Church Street and include Congers House, Farrer House and Berthon Street. To the west of the site are the rear façades of the mixed residential and commercial properties on Deptford High Street and St Joseph's Roman Catholic Primary School. Figure 25.1 to Figure 25.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

25.1.4 Existing access to the site is from Coffey Street and Crossfield Street. The site lies inland; approximately 600m south of the River Thames

Figure 25.2 Aerial view of existing site



25.1.5 A Grade II listed mid-19th century London to Greenwich Railway viaduct is located within the south-eastern corner of the site. Listed buildings close to the site include the Parish Church of St Paul's, adjacent to the north of the site, which is a Grade I listed building, constructed in 1730, whilst the walls of its churchyard are Grade II listed. The walls of the former graveyard belonging to the Old Baptist Chapel are also Grade II listed and lie immediately adjacent to the northern boundary of the site.

25.1.6 The site lies within the St Paul's Conservation Area and also sits within Upper Deptford Archaeological Priority Area.

25.1.7 The St Paul's Churchyard and Crossfield Open Space Site of Importance for Nature Conservation covers the majority of the main site and is designated based on the diversity of flora and local nesting habitat for birds that the area provides. The area also makes up part of the London Borough of Lewisham's open space plan.

25.1.8 Air quality management designations have been made by the London Borough of Lewisham, one of which covers the site. This designation is made where pollutant levels (mainly from road vehicles) are above set standards. There are no other environmental designations on or adjacent to the site.

Figure 25.3 Deptford Church Street – site context

View of site looking east

St. Paul's Grade I listed church to the east and outside the site

25.2 Proposed development

25.2.1 The purpose of this 1.2 hectare site would be to intercept a sewer which currently discharges untreated sewage into the River Thames on average 36 times each year, at a total volume of 1,470,000 cubic metres. This is equivalent to approximately 588 Olympic sized swimming pools. Once the existing sewer is intercepted and with flows diverted into the proposed main tunnel, there would be approximately four discharges of untreated sewage into the River Thames per year from this combined sewer overflow.

25.2.2 In addition to the main site, four small site areas each of approximately 0.02 hectares would be used for the temporary relocation of bus stops on Deptford Church Street.

25.2.3 Construction at the main Deptford Church Street site is assumed to start in 2016 and to be completed by 2020.

25.2.4 Flows would be transferred from the relatively shallow depth of the existing sewer to the deeper level of the main tunnel via a drop shaft and the Greenwich connection tunnel. The shaft would be approximately 48 metres deep with an internal diameter of approximately 17 metres.

25.2.5 To intercept the flow in the existing sewer, a chamber would be constructed on the sewer which is located beneath Deptford Church Street. This would require the temporary closure of the northbound bus and traffic lanes on Deptford Church Street adjacent to the site. During these works traffic flow on the southbound carriageways adjacent to the site would be altered to provide one lane of traffic in each direction. In addition four bus stops and a pedestrian crossing on Deptford Church Street would be temporarily relocated.

25.2.6 Further temporary changes to the local traffic system would include construction of a new section of road on the south side of the site to link

Crossfield Street to Coffey Street. A one-way system would then be implemented along Crossfield Street and Coffey Street.

25.2.7 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, ensuring safety for road users and pedestrians by controlling movement of vehicles, and restricting working hours to limit the effects of noise on neighbours.

25.2.8 As this site is inland, excavated material arising from construction of the shaft and other structures would be transported from the site by road, rather than by barge on the river.

25.2.9 During construction, vehicles would access the construction site from Crossfield Street, via Deptford Church Street, where a new site entrance would be constructed. Vehicles would leave the site via a new exit on Coffey Street and then return to Deptford Church Street. The average peak daily number of lorry trips at this site would be 32.

25.2.10 The plan below (Figure 25.4) shows the layout of the proposed development for which consent is sought. This plan shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed siting of the permanent works. The assessments within the *Environmental Statement* have considered the ‘worst-case’ location in relation to each topic to ensure that the findings are robust.

25.2.11 To help explain this information, the schematic diagram below (Figure 25.5) illustrates the layout of where the structures may be located within these zones.

25.2.12 While most of the structures would be underground, four 6 to 8 metre high ventilation columns and a smaller diameter 6 metre high ventilation column would be needed for ventilation of the shaft and interception structures. Four of these columns would be located to the south of the site close to Crossfield Street and the 6m high column would be located near Deptford Church Street. The height of the four new ventilation columns in combination with below ground filters, would control odour and minimise any effects on local residents and users of the public realm. These are shown in an illustrative above ground plan in Figure 25.6.

25.2.13 An electrical and control kiosk, approximately 2.8 to 3 metres high would be located on the eastern side of the site next to Deptford Church Street. Plant within the kiosk would be used by Thames Water to operate below ground equipment.

25.2.14 Once the construction works are complete the site would be returned to public realm and landscaped to provide a high quality public amenity space. The landscape plan would include areas of hardstanding sufficient for access by operation and maintenance vehicles to the works.

25.2.15 No new lighting would be provided, except for a low level light to allow safe access to the kiosk for maintenance. This would only be activated when required.

25.2.16 Once operational there would be routine inspections to the site every three to six months and important maintenance work carried out every ten years. Vehicle access to the site would be from three new permanent access points, one constructed from Crossfield Street and two from Coffey Street.

Figure 25.4 Proposed development at Deptford Church Street site

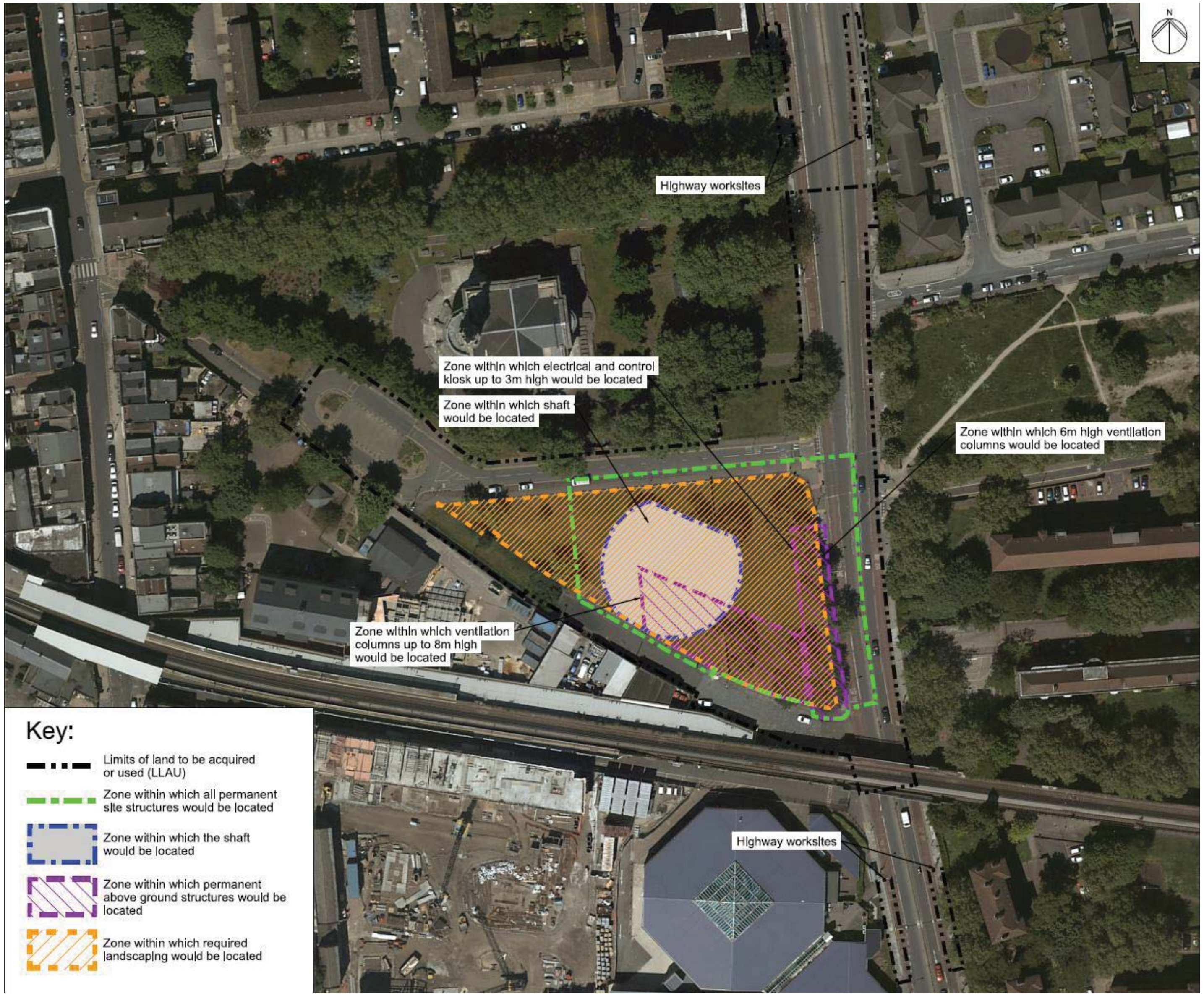


Figure 25.5 Schematic layout at Deptford Church Street site

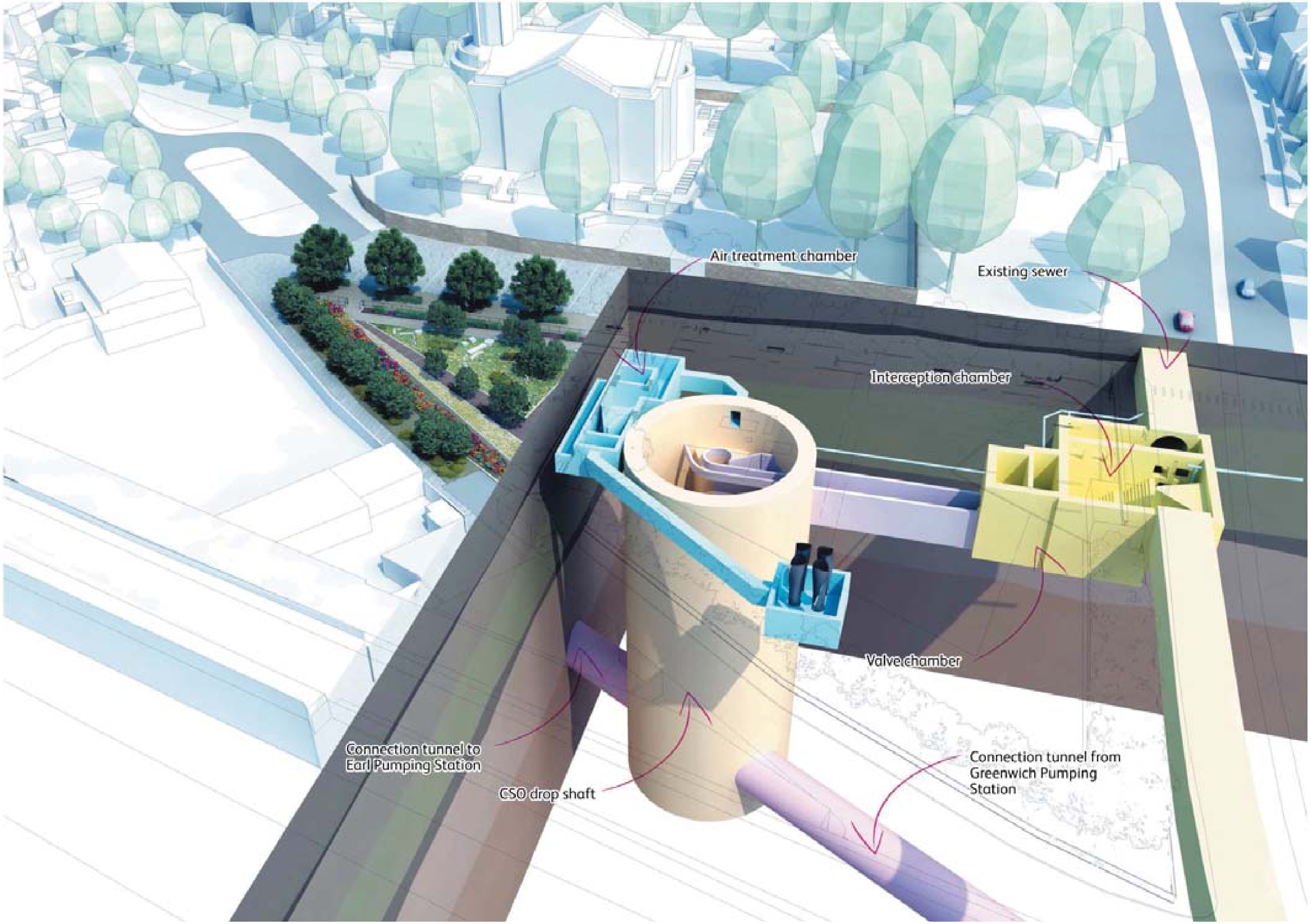


Figure 25.6 Deptford Church Street site – illustrative aerial view

25.3 Effects of the proposed development at Deptford Church Street on the environment

Introduction

25.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour
b. Ecology (land based and river based)
c. Historic environment
d. Land quality
e. Noise and vibration
f. Socio-economics
g. Townscape and visual
h. Transport
i. Water (surface and below ground)
j. Flood risk

25.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

25.3.3 The following section describes the site effects (both beneficial and adverse) arising from the proposed development at the Deptford Church Street site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the main tunnel is built and operational. The full details for each topic are contained in Volume 23 of the *Environmental Statement*.

Effects during construction

25.3.4 During construction there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties. Pollutant levels are currently high across the London Borough of Lewisham. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on nearby properties. This is due to the small increase in pollutant concentrations predicted.

25.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

25.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. The extra vehicles associated with the construction would result in a small increase to future traffic levels however this would not result in a significant increase in noise.

25.3.7 The noise of construction activities, generated by construction plant and vehicles, would be controlled on site through measures such as barriers to noise between sources and local properties. However, during certain periods of construction, noise levels are anticipated to rise above the relevant standards at the neighbouring St. Paul's Church and St. Joseph's Primary School. When this occurs, there would be significant adverse noise effects at these properties. The predicted construction related increase in noise levels at St. Joseph's Primary School and St Paul's Church would not qualify them for noise insulation. As such the adverse noise effects at these receptors would remain significant however they may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme*.

25.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

25.3.9 In terms of townscape, significant adverse effects are likely within the site and the adjacent St Paul's Conservation Area during the construction phase. A number of residents' views across the site would experience significant adverse effects during construction (residents on Berthon Street at the junction with Deptford Church Street, at the rear of Bronze Street, to the south of the railway on Deptford Church Street, the section of Deptford High Street close to Diamond Way). Significant adverse effects would also be experienced from views from St Paul's Church (Figure 25.7).

Figure 25.7 View from St. Paul's church towards existing site (upper photograph) and with construction works in place (lower photomontage)

25.3.10 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. It also considers local land uses. Significant adverse effects are predicted on the educational facilities of St Joseph's Primary School. The school may be eligible for compensation however this compensation would not be considered to mitigate the amenity effects. However financial losses arising on St Paul's Church are anticipated to be sufficiently mitigated through application of compensation measures.

25.3.11 The measures proposed as part of the project to minimize disruption and ensure safety of road users, including pedestrians, would help to avoid significant transport effects. However, significant adverse effects are predicted to pedestrians using the local streets, businesses and, workplaces, St Joseph's Primary School and St Paul's Church as a result of the construction works, mainly as a result of an additional road crossing that would be required for many (Figure 25.8).

Figure 25.8 View from site northwards to Coffey Street and St. Paul's Grade I listed church

25.3.12 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up. Construction work on site would involve changes to both above ground features as well as the environment below ground.

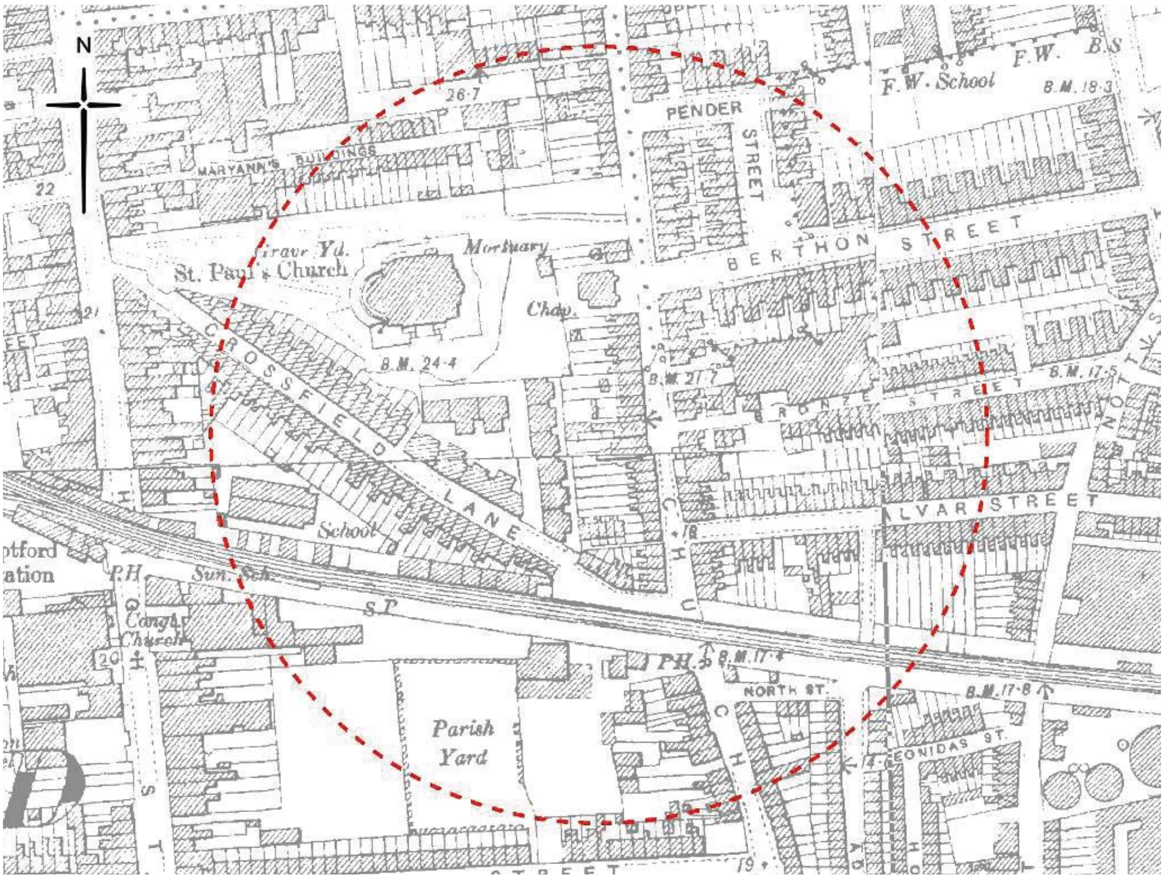
25.3.13 Information gathering has revealed that, although the probability is low, remains from Prehistoric and Roman times are possible at the site. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

25.3.14 The proposed development is anticipated to have significant adverse effects on the historic character of the St Paul's Church conservation area and would also have significant adverse effects on the setting of St Paul's Church (Figure 25.9).

Figure 25.9 Church of St Paul from Deptford Church Street looking northwest

25.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past. The site is considered to have potential for minor contamination given the historic use as Victorian era residential properties (Figure 25.10) until the 1970's when the site was cleared for its current use. No likely significant land quality effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

Figure 25.10 Ordnance Survey 2nd edition 25" scale map of 1896 (not to scale)



25.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the groundwater (commonly termed a 'pathway') is created, resulting in pollution. Groundwater resources may also be affected as a result of the removal of substantial volumes of water from the ground during construction. At the Deptford Church Street site the geology is such that the new below ground structures would be at a depth where groundwater would be present. Due to the geology of the site and the past land use the removal of groundwater at the site would be limited through the implementation of special construction techniques such as removing water from within the shaft as it is built, rather than from outside it. Given these measures, no significant effects on groundwater are likely to occur.

25.3.17 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. Although the Deptford Church Street site lies inland, the existing sewer is connected to a discharge point in the River Thames and therefore impacts on surface water may occur. At the site the route for pollution to enter watercourses would be through on site spillages or via the removal of contaminated groundwater. A number of control measures would be applied to prevent substances from leaving the site and entering surrounding watercourses or waterbodies. Pollutants would either go to existing drains or be collected and treated on site. Based on the application of these measures, no significant surface water effects would occur.

25.3.18 Flooding may occur from various sources for example tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, the finding of the flood risk assessment for the site is that there would be no change in flood risk during construction and there would be no significant effect in respect of flood risk.

25.3.19 Construction effects would only occur for river based ecology where construction activities take place in-river. As this site is inland there would be no significant effects.

25.3.20 Habitats affected by site clearance would be reinstated at the end of construction so no significant adverse effects are predicted on either the surrounding sites designated for nature conservation, the local nature reserve or the site itself in ecological terms. During construction, control measures would ensure there would be no significant adverse effects on land based ecology.

25.3.21 Two other developments have been identified which would be under construction during the peak construction year at Deptford Church Street, namely Giffin Street Regeneration Area and Creekside Village East. It is considered that visual effects from one view point (which is already predicted to experience a significant effect) may be slightly elevated as a result of the cumulative developments. No other effects have been identified which would interact cumulatively with construction work for Deptford Church Street.

Effects during operation

25.3.22 Four 6 to 8 metre high ventilation columns and a smaller diameter 6 metre high ventilation column would be needed for ventilation of the shaft and interception structures. Air treatment filters would be installed to remove odour prior to release from the ventilation column. The height of the ventilation columns would allow the elevated release of expelled air and therefore there would be no significant effect from odour.

25.3.23 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

25.3.24 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would require short-term temporary parking restrictions on adjacent roads to allow safe access to the site. This relatively minor operational activity would not lead to significant effects.

25.3.25 There are no significant effects predicted on the townscape character areas surrounding the site as features remaining on site would be well designed. Most viewpoints would experience no significant effects.

25.3.26 The above ground operational structures and landscaping would have significant beneficial effects on the St Paul's Conservation Area and the nearby the Grade I listed St Paul's Church. This would be due to the improved appearance of the character area and improved views of the church that would be provided by the landscape design.

25.3.27 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

25.3.28 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

25.3.29 The effect of the project would be to substantially reduce flows of sewage into the River Thames from the Deptford Storm Relief combined sewage overflow discharge point. As a result, there would be significant benefits to water quality.

25.3.30 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology. Fish and invertebrates would benefit from the reduced pollution, leading to a general increase in numbers and species diversity.

25.3.31 No significant effect on socio-economic amenity is anticipated once the Deptford Church Street site is complete.

25.3.32 No other developments are planned nearby that would interact with the operation of the project at the site and so no significant cumulative effects have been identified.

25.3.33 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Land quality effects have not been assessed for the operational development. Once the construction phase has been completed the site would be finished such that contamination retained below ground on site would not come into contact with any site operators or members of the public.

c. Given the limited area taken up by the operational site, the infrequent maintenance requirements and that the design involve only minimal lighting being used, significant effects on land based ecology are not likely, and therefore has not been assessed.

25.4 Further information

25.4.1 Further information regarding the assessment of the Deptford Church Street site can be found in Volume 23 of the *Environmental Statement*.

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26 Greenwich Pumping Station

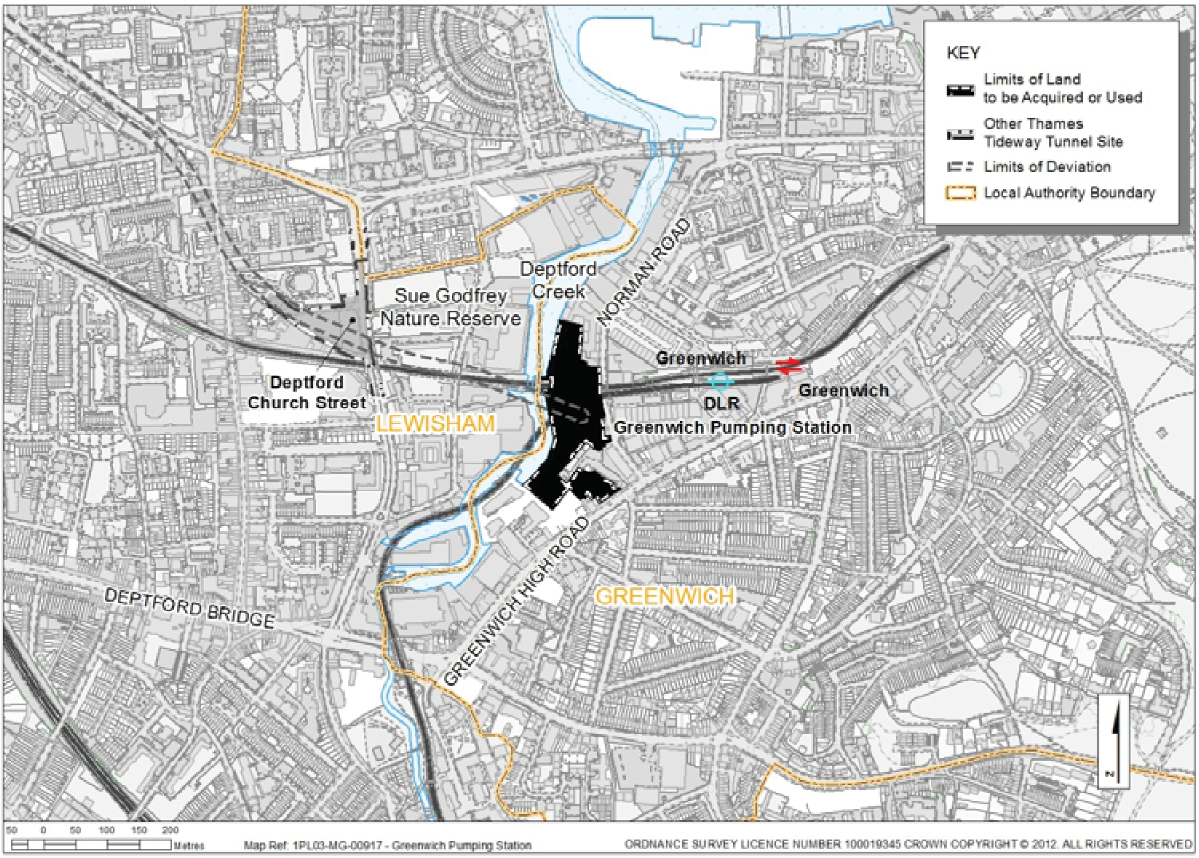
26.1 Existing site context

26.1.1 The proposed site consists of the existing Thames Water Greenwich Pumping Station operational site and Phoenix Wharf to the north. The site is located in the Royal Borough of Greenwich but is adjacent to the local authority boundary with the London Borough of Lewisham which lies immediately to the west.

26.1.2 The site is bisected by the elevated Dockland Light Railway and a Network Rail viaduct which traverse the site from east to west.

26.1.3 The part of the site north of the railways contains Phoenix Wharf which is industrial in nature. This area is bounded by Brookmarsh Trading estate to the north, Norman Road and the Greenwich Centre Business Park to the east and Deptford Creek to the west.

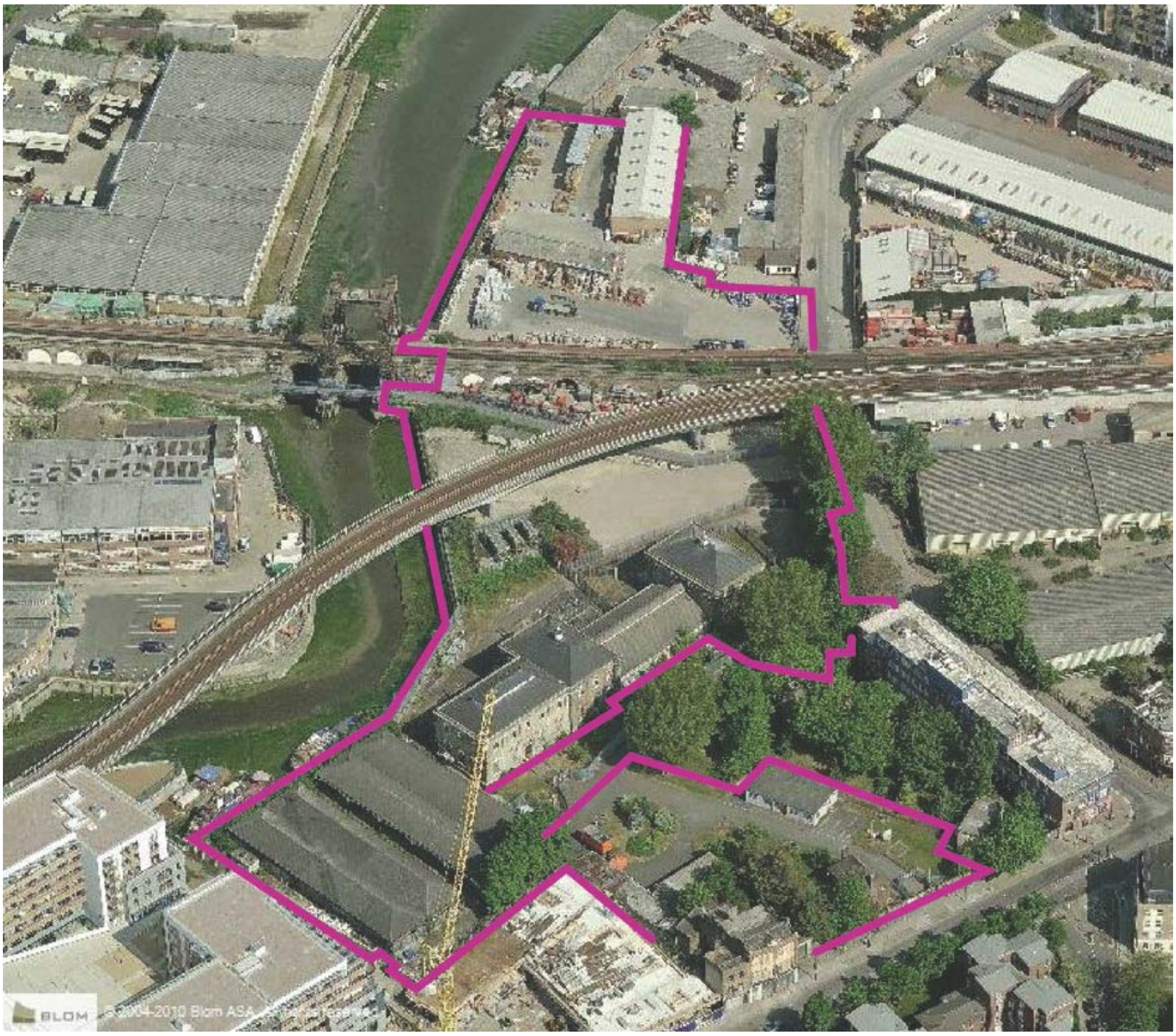
Figure 26.1[1] Location of proposed Greenwich Pumping Station site



[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

26.1.4 The area south of the railways comprises the existing Thames Water Greenwich Pumping Station site. Norman Road forms the eastern boundary of the site with the currently disused Greenwich Industrial estate situated beyond this. The south-eastern boundary is formed by Norman House while residential properties lie to the south of the site, adjacent to Greenwich High Street. Deptford Creek is the western boundary of the site. Figure 26.1 to Figure 26.3 show the site and local context.

Figure 26.2 Aerial view of existing site



26.1.5 Existing site access to the pumping station is off Greenwich High Road (A206) and to Phoenix wharf is off Norman Road (B208).

26.1.6 Air quality management designations have been made by the Royal Borough of Greenwich covering the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

26.1.7 Deptford Creek, as a tributary of the River Thames, is designated a Site of Importance for Nature Conservation.

26.1.8 The Ashburnham Triangle Conservation Area lies to the south of Greenwich High Road and the Deptford Creekside Conservation Area lies to the west of the site, adjacent to Deptford Creek.

26.1.9 The site contains four listed buildings, including the Network Rail railway viaduct that crosses the centre of the site and three buildings associated with the original Deptford (Greenwich) Pumping Station, which was built in the early 1860s.

26.1.10 The site lies within an extensive Archaeological Priority Area as designated by the Royal Borough of Greenwich. There are no other environmental designations on or adjacent to the site.

Figure 26.3 Greenwich Pumping Station – site context

Grade II listed Greenwich Pumping Station

Deptford Creek looking south-west towards the site

View north looking along Norman Road

View west along railway track

26.2 Proposed development

26.2.1 The purpose of this 2.1 hectare site would be to intercept sewers which currently discharge untreated sewage into the River Thames on average 51 times each year, at a total volume of 8,320,000 cubic metres. This is equivalent to approximately 3,328 Olympic sized swimming pools. Flows would be transferred from the relatively shallow depth of the existing pipework to the deeper level of the Greenwich connection tunnel via a drop shaft and then onto the Thames Tideway Tunnel. Once the existing sewer is intercepted and with flows diverted into the proposed Thames Tideway Tunnel, there would be approximately four discharges of untreated sewage into the River Thames per year from this combined sewer overflow.

26.2.2 The drop shaft, approximately 46 metres deep with an internal diameter of approximately 17 metres, would be constructed in the existing Thames Water Pumping Station compound to the north of the existing pumping station building.

26.2.3 The site would also be used to facilitate construction of the Greenwich connection tunnel which would run between the Greenwich Pumping Station site and the Chambers Wharf site, in the London Borough of Southwark, to the west.

26.2.4 Construction at the Greenwich Pumping Station site is assumed to start in 2016 and be complete by 2021.

Figure 26.4 Building yard located within proposed development site

26.2.5 The connection tunnel to Chambers Wharf would be built using a tunnel boring machine. This machine would be lowered into the shaft and, once underway, would travel westwards working 24 hours per day to help make sure that the work is completed safely, efficiently and in the least time. The tunnel boring machine would progressively excavate the ground and line the tunnel with precast concrete 'segments'. The excavated material would be transported via the shaft to the site and removed from site as described below. The segments would be joined together to make the circular outer lining of the tunnel. When the tunnel boring machine reaches the shaft at the Chambers Wharf site it would be dismantled at the base of the shaft and removed by crane at this site. It has been assumed that an inner lining, called a secondary lining, would then be constructed from both the Greenwich Pumping Station and the Chambers Wharf sites, by pumping wet concrete into temporary supports used to form the final inside shape of the tunnel.

26.2.6 The shaft at the Greenwich Pumping Station site would be used to take all excavated material out of the tunnel as the tunnel boring machine progresses. It would also be used to deliver precast concrete segments.

26.2.7 All construction would be controlled to reduce potential impacts. There would be an enclosure located over the shaft during 24 hour working to reduce noise effects on local residents. In addition, there would be other environmental controls in place throughout the construction phase to reduce potential impacts. These would include measures such as damping down materials and site roads to control dust, and ensuring safety for road users and pedestrians by controlling movement of vehicles.

26.2.8 Excavated material arising from construction of the shaft, tunnel and other structures would be transported from the site by road.

26.2.9 During construction, vehicles would access/egress the construction site from four new access points on Norman Road. The existing access to the Thames Water site on Greenwich High Road would also be used. The average peak daily number of lorry trips at this site would be 77.

26.2.10 The plan below (Figure 26.5) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the detailed location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

26.2.11 To help explain this information, the schematic diagram below (Figure 26.6) illustrates the layout of where the structures may be located within these zones.

26.2.12 Whilst most of the works are below ground, the top of the shaft would be about 1.5 metres above ground level and ventilation structures located on top of the shaft about 3 to 5 metres above ground level. There would also be a new valve chamber that would extend about 1.5 metres above ground level. Ventilation equipment, needed for ventilation of the shaft and interception structure as well as electrical and control equipment, would be located within an existing building on the Pumping Station site. This equipment would control odour and minimise any effect on local residents and offices in the area. These above ground structures are shown in an illustrative above-ground plan in Figure 26.7.

26.2.13 Once construction is complete, the site would remain a Thames Water operational site. The landscape plan would include areas of hardstanding sufficient for access by operation and maintenance vehicles to the works.

26.2.14 Operational lighting would be the same as existing, with the addition of a low level light to allow safe access to the steps to the shaft surface for maintenance. This would only be activated when required.

26.2.15 Once operational there would be routine inspections to the site every three to six months and important maintenance work carried out every ten years. Permanent access to the site would be from the existing access gates on Greenwich High Road and a new vehicle access gate on Norman Road.

Figure 26.5 Proposed development at Greenwich Pumping Station site

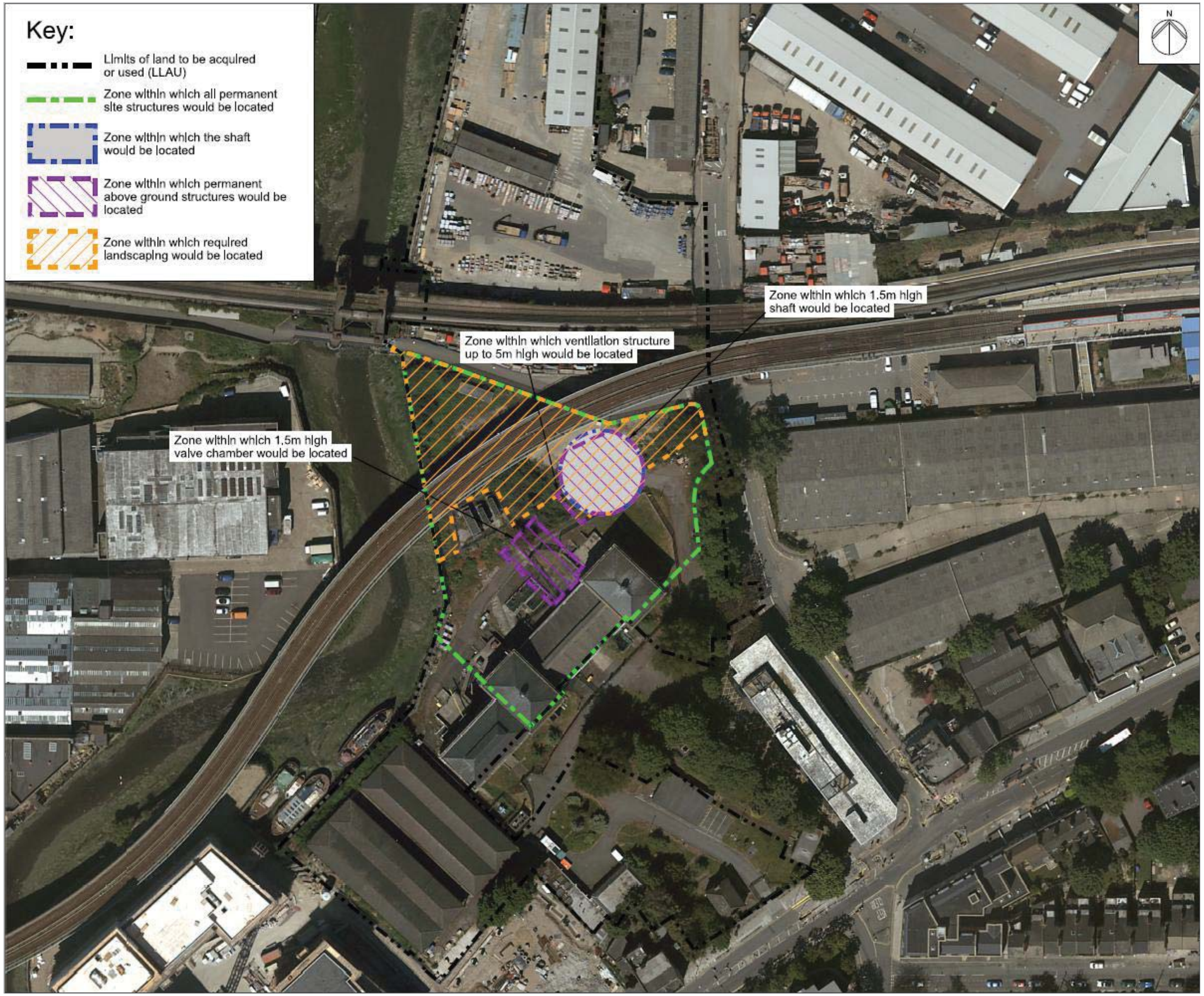


Figure 26.6 Schematic layout at Greenwich Pumping Station site

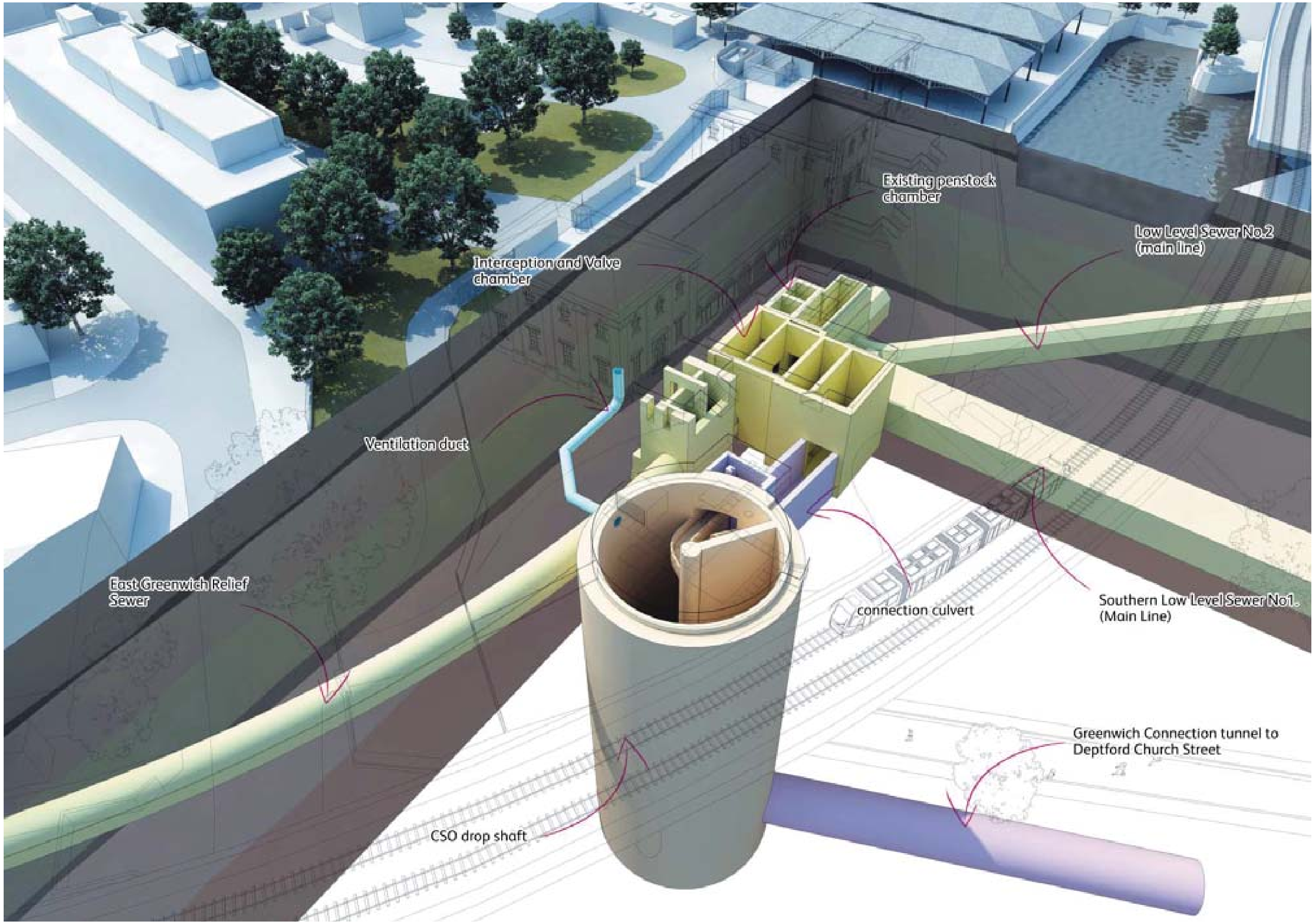


Figure 26.7 Greenwich Pumping Station site – illustrative aerial view

26.3 Effects of the proposed development at Greenwich Pumping Station on the environment

Introduction

26.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology – (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

26.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

26.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Greenwich Pumping Station site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 24 of the *Environmental Statement*.

Effects during construction

26.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties. Pollutant levels are currently high across the London Borough of Greenwich and the neighbouring authority of London Borough of Lewisham. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on nearby properties. This is due to the small increase in pollutant concentrations predicted.

26.3.5 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry dirt onto local roads which may then create dust when disturbed by other vehicles. Controls would be applied during construction including dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

26.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. The extra vehicles associated with the construction would result in a small increase to future traffic levels which would not result in a significant increase in noise. The presence of a noise enclosure around the shaft would help reduce noise from construction plant at night, at times when 24 hour working would be required. Other control measures and barriers to noise between the source and local properties would also help reduce noise and therefore effects from construction would not be significant.

26.3.7 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

26.3.8 In terms of townscape, there are no significant effects predicted either to the character of the Greenwich Pumping Station site or the surrounding areas which have low sensitivity to change.

26.3.9 Significant adverse effects are predicted for a number of residential viewpoints within the immediate surrounds of the site. This is largely due to the visibility of the site during the day and the presence of construction plant. At night the level of lighting would not result in significant adverse effects on the same viewpoints. Significant adverse effects are predicted for the recreational viewpoint on the footbridge across Deptford Creek, which would overlook the southern part of the site. No other recreational viewpoints would experience significant adverse effects during construction.

26.3.10 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. It also considers local land uses such as nearby amenity space. Given that the only significant effects identified are from the adverse visual effects of the construction site, and some of these views would be screened, the effects on amenity would not be significant.

26.3.11 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that no significant transport effects would occur.

26.3.12 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up. Construction work on site would involve changes to both above ground features as well as the environment below ground.

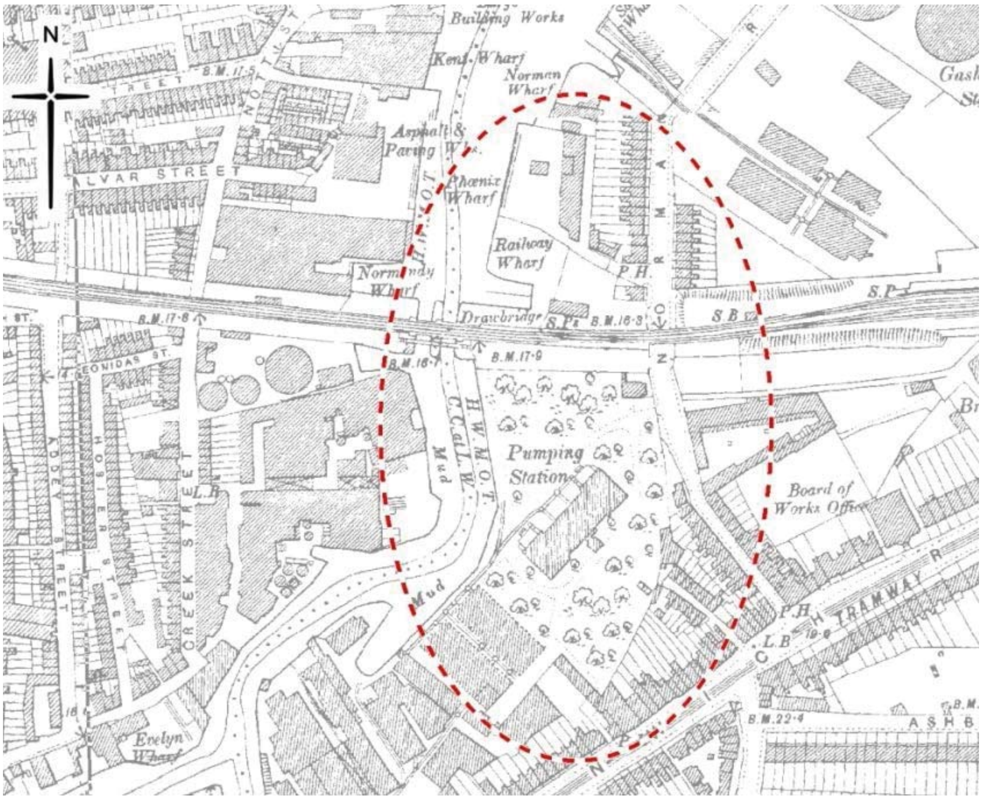
26.3.13 Information gathering has revealed that there is a high potential for post-medieval buildings and 19th and early 20th century remains to be present on site. There is also a low potential that burial remains are present on site associated with a possible congregational chapel. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

26.3.14 Above ground features of interest include the following listed buildings: 19th century East Beam Engine House, Greenwich Pumping Station and Coal Shed and the London and Greenwich Railway viaduct (Figure 26.8). These would all be unaffected by the works except the East Beam Engine House which would be brought back into use as part of the development as described above. Given this, there would be no significant effects on above ground features during the construction.

Figure 26.8 Grade II listed viaduct built by the London to Greenwich railway in 1838 looking northwest

26.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination (Figure 26.9). This may in turn affect construction workers and adjacent premises. Due to the current and historic use of the southern site as sewage pumping station soil contamination may be present. The historical land uses of the northern part of the site include railway works from the 19th century and more recently a builders merchant. No likely significant effects have however been identified. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The application of these measures means there would be no significant effects.

Figure 26.9 Ordnance Survey map of 1896–8 (not to scale)



26.3.16 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the groundwater (commonly termed a ‘pathway’) is created, resulting in pollution. Groundwater resources may also be affected as a result of the removal of substantial volumes of water from the ground to enable construction. At this site the geology is such that the below ground structures would be at a depth where groundwater would be present. Due to the geology of the site and the past land use the removal of groundwater at the site would be limited through the implementation of special construction techniques such as removing water from within the shaft as it is built, rather than from outside it. Given these measures, no significant effects on groundwater are likely to occur.

26.3.17 As with groundwater, surface water quality can also be affected when pathways for pollutants are created. At this site the most likely route for pollution to enter watercourses would be via the removal of any contaminated groundwater and its subsequent disposal. A number of control measures would be applied to prevent substances from leaving the site and entering Deptford Creek or the River Thames, including the appropriate treatment of extracted groundwater. Treated water would either go to existing drains or, if appropriate treatment was not possible, polluted water would be collected and sent for licensed disposal. Based on the application of these measures, no significant effects on surface water would occur.

26.3.18 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, based on the assessment there would be no change in flood risk during construction.

26.3.19 Construction effects would only occur for river based ecology where construction activities take place in-river. As no in-river works are planned at this site there would be no significant effects on in river based ecology.

26.3.20 The existing Greenwich Pumping Station site is an area of local value for land based ecology. Planting of replacement trees, scrub and wildflower grassland would be provided on completion of works, resulting in no overall loss in habitat on site. As a result no significant effects on habitats are anticipated.

26.3.21 During construction control measures would be in place such as noise screening and minimising light spillage. The effects on species that use the site and immediate surrounds, including birds and bats, would be minimal. Therefore, there would be no significant effects on ecology.

26.3.22 The Creekside Village East development would be under construction during the peak construction year at this site. However, no cumulative significant effects have been identified for any of the topics detailed above.

Effects during operation

26.3.23 The operational site would include ventilation equipment within the existing buildings on site. Ventilation structures would also be located on top of the shaft at between 3 to 5 meters above ground level. The ventilation structures would allow the elevated release of expelled air and inclusion of air treatment filters would mean that there would not be a significant effect from odour.

26.3.24 Noise and vibration from operational plant, the filling of the tunnel, maintenance activities, as well as from operational traffic has been considered. Any noise generated by ventilation and other plant equipment would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. Any noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and furthermore, as flows would be underground, there would be no significant effect. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

26.3.25 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger equipment such as cranes would be required. This relatively minor operational activity would not lead to significant effects.

26.3.26 There would be minor improvements to the façade of the East Beam House of the pumping station. New planting and wildflower habitat would also benefit townscape and visual amenity although. These benefits would not be significant.

26.3.27 The sensitive alterations to the East Beam Engine House would be complimentary and consistent with the original function of the building. Bringing the building back into use would help to ensure its survival and upkeep. As a result there would be a significant beneficial effect.

26.3.28 Groundwater levels and quality could be affected by seepage into and out of the shaft, however the risk of this would be low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

26.3.29 The fully built scheme would not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

26.3.30 The effect of the project at this site would be to substantially reduce flows of sewage into the River Thames from the discharge point to which the site is connected, resulting in significant benefits to water quality.

26.3.31 Associated with the improvement in water quality, would be significant beneficial effects on the river based ecology (river based ecology surveys at Deptford Creek are shown in Figure 26.10). Fish would benefit from the reduced pollution, leading to a general increase in numbers and species diversity.

Figure 26.10 Fish survey at Deptford Creek

26.3.32 No other developments are planned nearby that would interact with the operation of the project at the site and so no significant cumulative effects have been identified.

26.3.33 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Socio-economic effects have not been assessed as the operational structures would be within the existing site boundary.

c. A number of design measures would be included to prevent any contamination related to the operation of the Thames Tideway Tunnel. The finishing of the site with an area of hard standing would prevent any site operators coming into contact with any contaminants retained below ground, and so land quality effects during operation were not assessed.

d. Given the limited area taken up by the operational site, the infrequent maintenance requirements and that the design would involve only existing lighting being used, aside from minimal low level lighting to the shaft surface, significant effects on land based ecology are not likely, and therefore were not assessed.

26.4 Further information

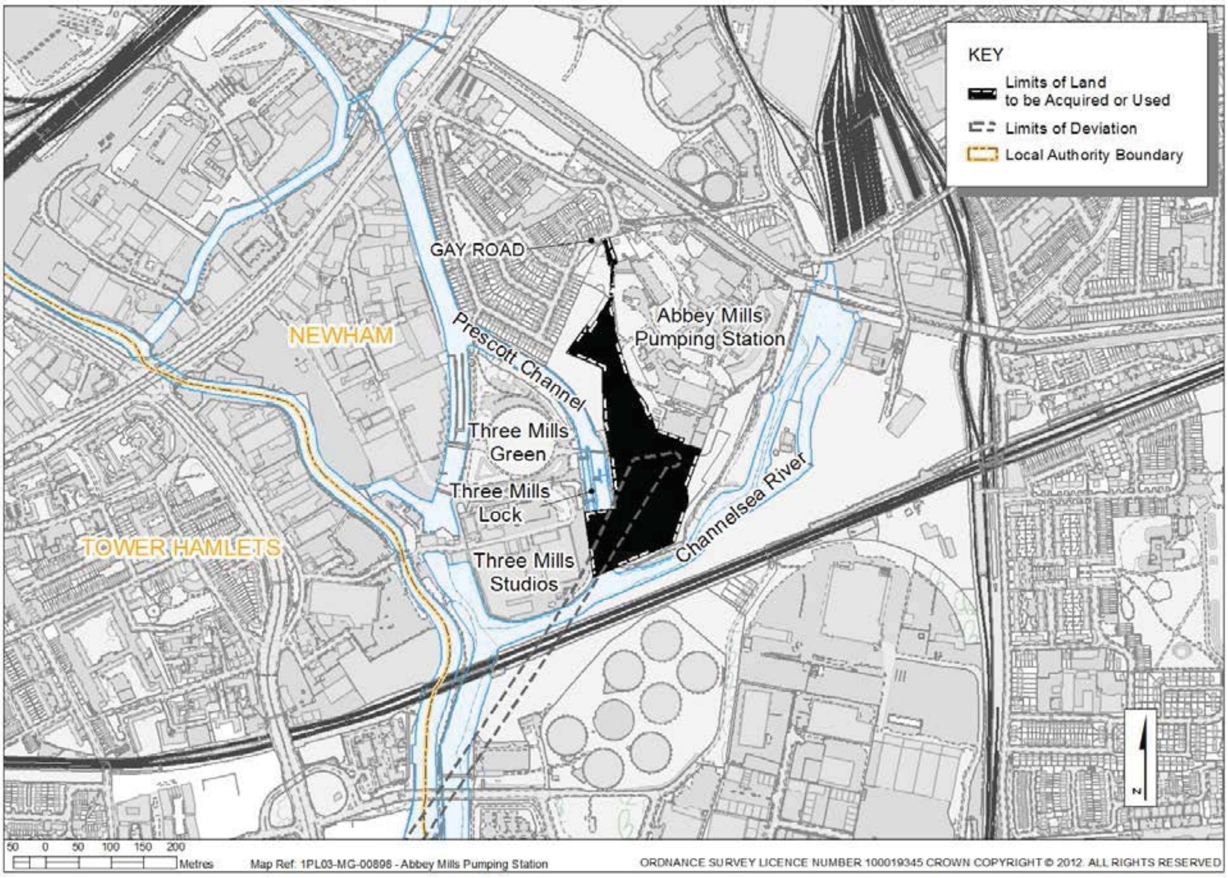
26.4.1 Further information regarding the assessment of the Greenwich Pumping Station site can be found in Volume 24 of the *Environmental Statement*.

27 Abbey Mills Pumping Station

27.1 Existing site context

27.1.1 Abbey Mills Pumping Station is an existing Thames Water pumping station site, located in the London Borough of Newham (see Figure 27.1). The site is approximately 250m to the east of the local authority boundary with the London Borough of Tower Hamlets.

Figure 27.1[1] Location of proposed Abbey Mills Pumping Station site



27.1.2 The proposed construction site is bounded to the north and northeast by operational infrastructure and buildings associated with the existing pumping station, to the east and southeast by the Channelsea River and Abbey Creek, to the west by the Prescott Channel, Three Mills Lock and allotments, and by Riverside Road to the northwest.

27.1.3 The surrounding land to the north of the site is predominantly residential with allotments immediately abutting the site. Land use in the wider area is predominantly industrial. Figure 27.1 to Figure 27.3 show the site and local context.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.'

27.1.4 Existing access to the site is from the A11 via Abbey Lane and Gay Road.

Figure 27.2 Aerial view of existing site

27.1.5 The site is within a London Borough of Newham air quality management designation. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

27.1.6 The surrounding watercourses are designated as Sites of Importance for Nature Conservation.

27.1.7 Several listed buildings are located northeast of the construction site within the Abbey Mills Pumping Station complex. The site also lies within the Three Mills Conservation Area and Lee Valley Archaeological Priority Area. There are no other environmental designations on or adjacent to the site.

Figure 27.3 Abbey Mills Pumping Station – site context

Sewer outfall Abbey Mills

Abbey Lane

27.2 Proposed development

27.2.1 The purpose of this 3.7 hectare site would be to facilitate construction of two sections of the main tunnel. One section of the main tunnel would be constructed from Chambers Wharf site located in the London Borough of Southwark. The tunnel boring machine used for this construction would be removed at Abbey Mills Pumping Station. The second section would be a short length of main tunnel to link the Thames Tideway Tunnel with the Lee Tunnel (currently under construction). This connection would be made to an existing shaft on the Lee Tunnel that is also located within the Abbey Mills Pumping Station site. The Thames Tideway Tunnel works at this site would not intercept any combined sewer overflow.

27.2.2 Construction at the Abbey Mills Pumping Station site is assumed to start in 2018 and be complete by 2021.

27.2.3 A shaft approximately 66 metres deep with an internal diameter of approximately 20 metres would be constructed between the Prescott Channel and the Lee Tunnel shaft.

27.2.4 When the tunnel boring machine travelling from the Chambers Wharf site arrives at the shaft at the Abbey Mills Pumping Station site it would be dismantled at the base of the shaft and removed by crane. An inner lining to the main tunnel, called a secondary lining, would be constructed partly from the Chambers Wharf site and partly from the Abbey Mills Pumping Station site.

27.2.5 The short section of main tunnel between the Thames Tideway Tunnel shaft and the Lee Tunnel shaft would be mechanically excavated and then concrete lined from the Abbey Mills Pumping Station site Thames Tideway Tunnel shaft. Once underway, tunnelling would continue on a 24 hour basis to help make sure that the work is completed safely and efficiently. The excavated ground would be transported via the shaft to the site and removed from the site by road transport.

27.2.6 There would be environmental controls in place throughout the construction phase to reduce potential impacts. Measures would include damping down materials and site roads to control dust, ensuring safety for road users and pedestrians by controlling movement of vehicles, and restricting working hours to limit the effects of noise on neighbours.

27.2.7 During construction vehicles would access and egress the site from Gay Road. The average peak daily number of lorry trips at this site would be 70.

27.2.8 The plan below (Figure 27.4) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

27.2.9 To help explain this information, the schematic diagram below (Figure 27.5) illustrates where the structures may be located within these zones.

27.2.10 While most of the structures would be underground, four ventilation structures and an electrical and control kiosk would be above ground. The ventilation structures would consist of one column that would be 8.5 metres high and three other ventilation structures of 2 to 5 metres high. The control kiosk would be 2.5m high.

27.2.11 The height of the ventilation column in combination with existing filters, would control odour and minimise any effect on surrounding residents. These are shown in an illustrative above ground plan in Figure 27.6.

27.2.12 On completion of the works, the site would be returned to use as part of the existing Thames Water operational site. Additional hardstanding areas would be provided to allow access for maintenance vehicles. No operational lighting would be provided.

27.2.13 Routine inspections would be made every three to six months and important maintenance work carried out every ten years. Once operational, access to the site would be from Gay Road using the existing Thames Water access.

Figure 27.4 Proposed development at Abbey Mills Pumping Station site

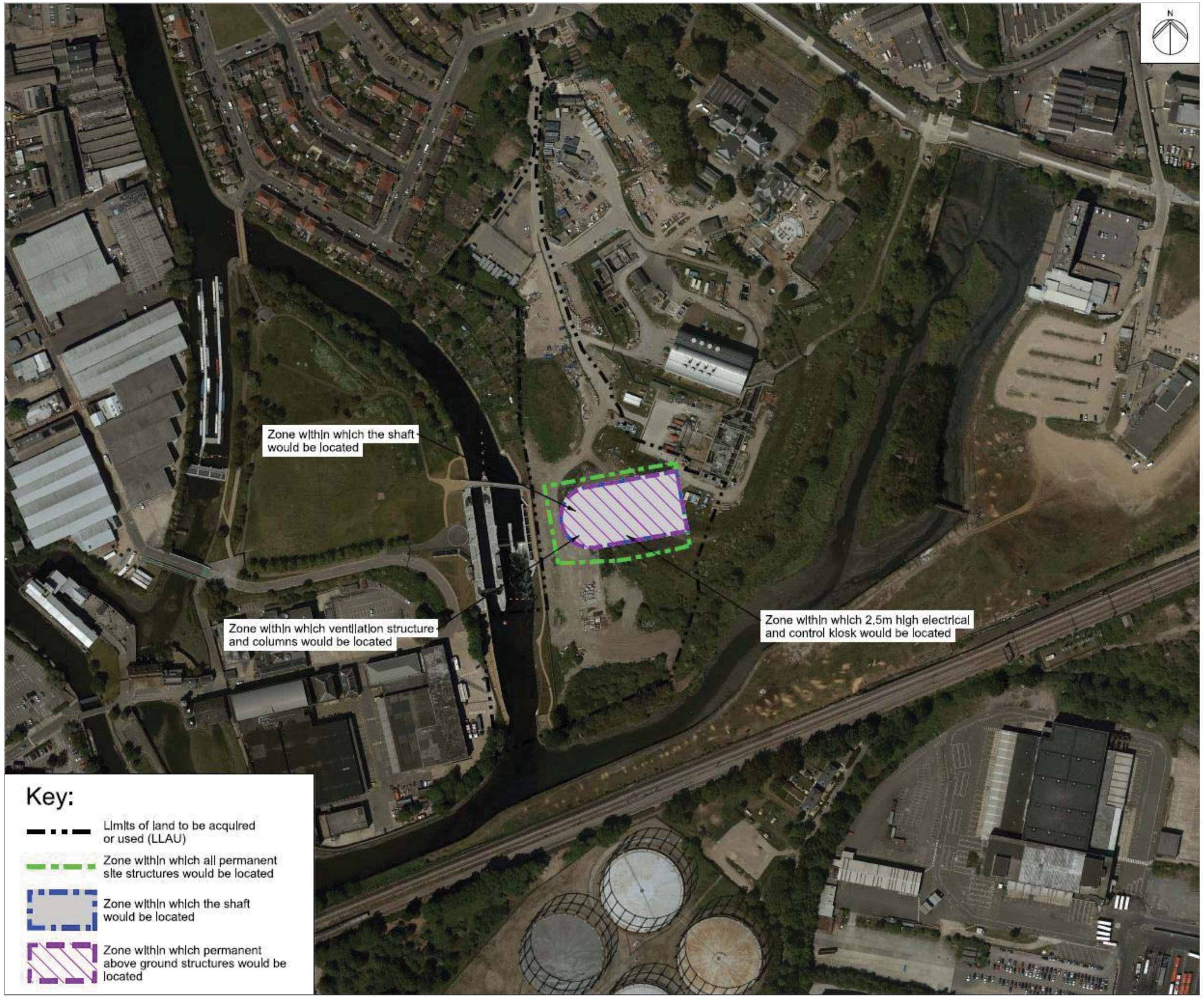


Figure 27.5 Schematic layout at Abbey Mills Pumping Station site

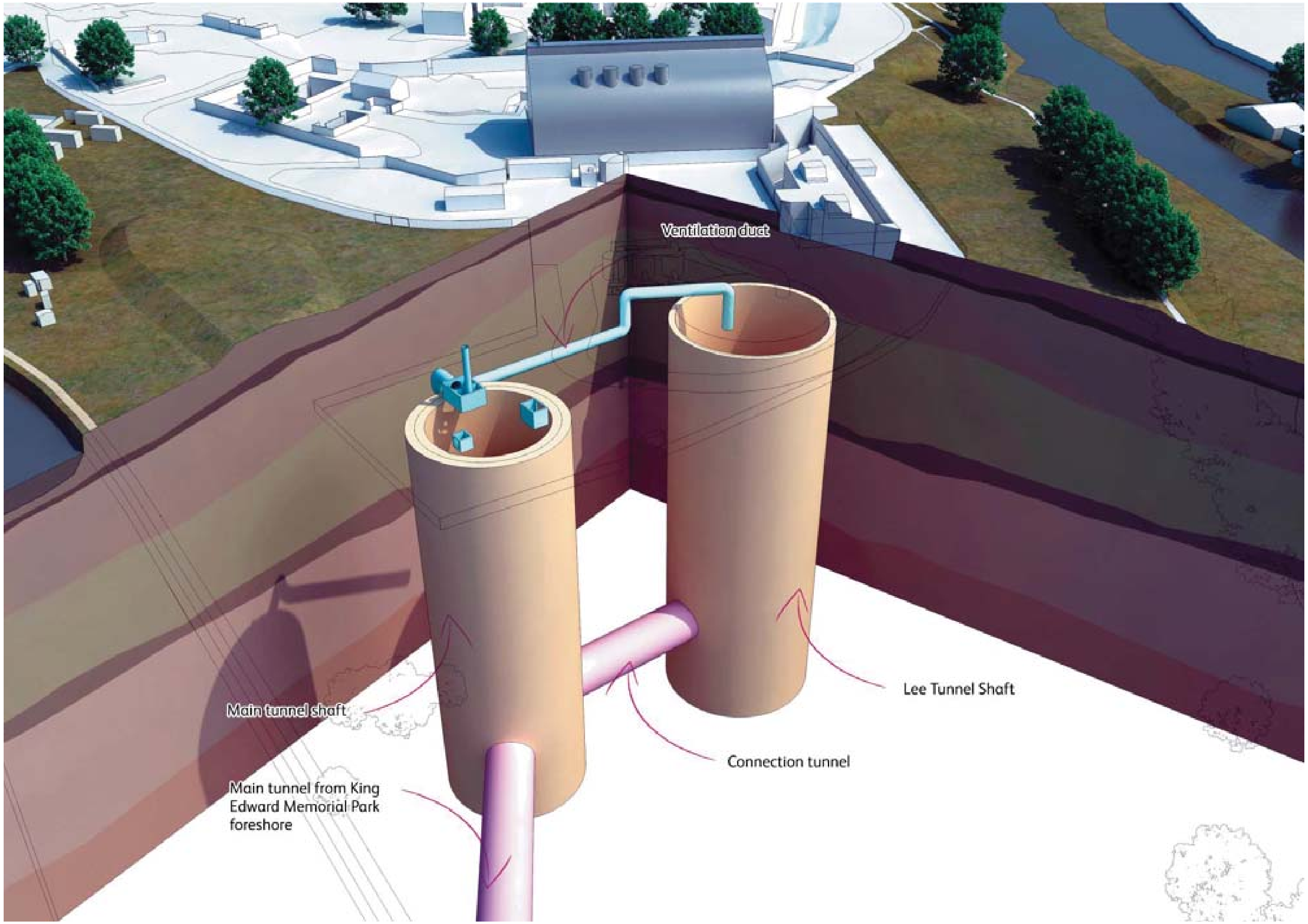


Figure 27.6 Abbey Mills Pumping Station site – illustrative aerial view

27.3 Effects of the proposed development at Abbey Mills Pumping Station on the environment

Introduction

27.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology – (land based and river based)

c. Historic environment

d. Land quality

e. Noise and vibration

f. Socio-economics

g. Townscape and visual

h. Transport

i. Water (surface and below ground)

j. Flood risk

27.3.2 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this Non-Technical Summary with full details contained in Volume 2 of the *Environmental Statement*.

27.3.3 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Abbey Mills Pumping Station site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel is built and operational. The full details for each topic are contained in Volume 25 of the *Environmental Statement.*

Effects during construction

27.3.4 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This could affect local residents and other sensitive land uses. Based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on nearby properties. This is due to the small increase in pollutant concentrations predicted.

27.3.5 An issue which is common to most construction sites (Figure 27.7) is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The control measures that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

Figure 27.7 Overhead view of construction of shaft for Lee Tunnel

27.3.6 Noise could arise from construction activities including the movement of construction traffic on roads outside the site and noise from equipment used on site. While there would be a small increase to traffic levels during construction, this would not result in a significant increase in noise. Control measures and barriers to noise between the source and local properties would help reduce noise from construction plant and therefore effects would not be significant.

27.3.7 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

27.3.8 In terms of townscape, significant adverse effects would occur on the townscape within the site and also on Three Mills. This would be due to the construction activity and presence of typical construction equipment and site hoardings. Elsewhere there would not be significant townscape effects.

27.3.9 People using the area around the site, including residents and those involved in recreation, may be subject to visual effects, that is effects on their experience of views. Significant adverse effects are predicted for a number of viewpoints including the northern end of Gay Road and also the view from Three Mills Green adjacent to the Prescott Channel. This is due to the visibility of the site and the presence of construction plant and vehicles. Further away, with only intermittent views of tall construction cranes, effects would not be significant.

27.3.10 Consideration of the amenity of local residents is provided in the assessment of socio-economics. This takes into account noise, vibration, air quality, construction dust and visual effects on local amenity. It also considers local land uses such as nearby allotments. Taking into account the various potential effects on amenity, it is predicted that the effects would not be significant.

27.3.11 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that no significant transport effects occur.

27.3.12 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up. Construction work on site would involve changes to both above ground features as well as the environment below ground.

27.3.13 Information gathering has revealed possible remains from the prehistoric era as well as remnants of medieval land management practices. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features would be likely.

27.3.14 The historic setting on the Three Mills Conservation Area, the Grade II Bromley Gas Works and the existing Abbey Mills Pumping Station (see Figure 27.8) would not be significantly affected since intervening features would provide screening from the construction works.

Figure 27.8 Grade II* Listed Abbey Mills Pumping Station

27.3.15 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. Contaminative land uses are known to have taken place on and around the site, including the current use as a pumping station. The surrounding area has previously supported a number of potentially contaminating activities including gas, oil and chemical works.

27.3.16 Workers on site would have the necessary health and safety equipment provided and adjacent sites would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. With the application of the measures described above, there would be no significant effects.

27.3.17 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter the water (commonly termed a 'pathway') is created, resulting in pollution. Groundwater resources may also be affected as a result of the removal of substantial volumes of water from the ground to enable construction. At the Abbey Mills Pumping Station site the below ground structures would be at a depth where groundwater would be present. The removal of groundwater would be limited through the implementation of techniques such as removing water from within the shaft as it is built, rather than from outside it. Given these measures, no significant effects on groundwater are likely to occur.

Figure 27.9 Ordnance Survey 1:10,000 scale map of 1954–96 (not to scale)

27.3.18 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, the finding of the flood risk assessment for the site is that there would be no change in flood risk during construction and there would be no significant effect in respect of flood risk.

27.3.19 During the construction of the main tunnel between the Thames Tideway Tunnel and the Lee Tunnel, the Lee Tunnel would be unavailable. As a result, it is likely there would be some discharges of untreated sewage during a period of approximately 44 weeks. While resulting in short-term changes, this would not affect the long term status of the River Lee and effects on surface water would therefore not be significant.

27.3.20 This short term release of untreated sewage is likely to have a significant adverse effect on river based ecology, through increased fish deaths and a temporary decrease in population in response to the pollution.

27.3.21 Noise, vibration and lighting have the potential to disturb marine mammals and fish. However, control measures would be in place such as noise screening and minimising light spillage. The effects on species that use the site and immediate surrounds, including birds and bats would be minimal. There would be a temporary loss of habitat related to site clearance but this would be reinstated at the end of construction. Effects during temporary construction works would therefore not be significant. Through the installation of bat roosting and bird nesting boxes, significant beneficial effects are likely on these species.

27.3.22 No other developments are planned nearby that would be under construction at the same time as the project and so no significant cumulative effects have been identified for the construction phase.

Effects during operation

27.3.23 The completed development would connect to air treatment filters to remove odour and a ventilation column which are being built as part of the Lee Tunnel project. Combined with the height of the proposed (for the Thames Tideway Tunnel) ventilation column at 8.5 metres, this would allow the elevated release of expelled air to ensure there would be no significant effect from odour. Noise and vibration from operational plant, maintenance activities and traffic has been considered. Any noise generated by ventilation and other plant equipment would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result, no significant noise and vibration effects are likely from maintenance activities.

27.3.24 Routine inspections would be made every three to six months during operation, with only very small numbers of vans required for visits. During tunnel maintenance, which would occur approximately once every ten years, larger vehicles would need to access to the site. This relatively minor operational activity would not lead to significant effects.

27.3.25 While groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

27.3.26 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

27.3.27 There would be a slight increase in discharge of untreated sewage from the Abbey Mills combined sewer overflows in relation to the operation of the development, with one spill approximately every ten years on average. While there would be a measurable change in surface water quality for the short duration of the discharge, this is not considered to be a significant effect.

27.3.28 No other developments are planned nearby that would interact with the operation of the project at the site and so no significant cumulative effects have been identified for the operational phase.

27.3.29 Operational effects at this site were not assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. Operational activities would have no effect on the historic environment, below or above ground, and therefore effects on the historic environment have not been assessed.

c. Due to the low height of the proposed above ground structures and their location within an existing pumping station operational compound, there would be no significant effects and therefore this has not been assessed.

d. No significant operational effects are considered likely for socio-economics and this has therefore not been assessed.

e. Land quality effects were not assessed for the operation of the project as once the construction phase has been completed the site would be finished. Any contamination retained below ground on site would not come into contact with any site operators or members of the public.

f. No operational effects are considered likely on aquatic ecology and therefore this has not been assessed.

g. Given the infrequent maintenance requirements and the fact that no new lighting is proposed, significant effects on land based ecology are not likely and therefore this has not been assessed.

27.4 Further information

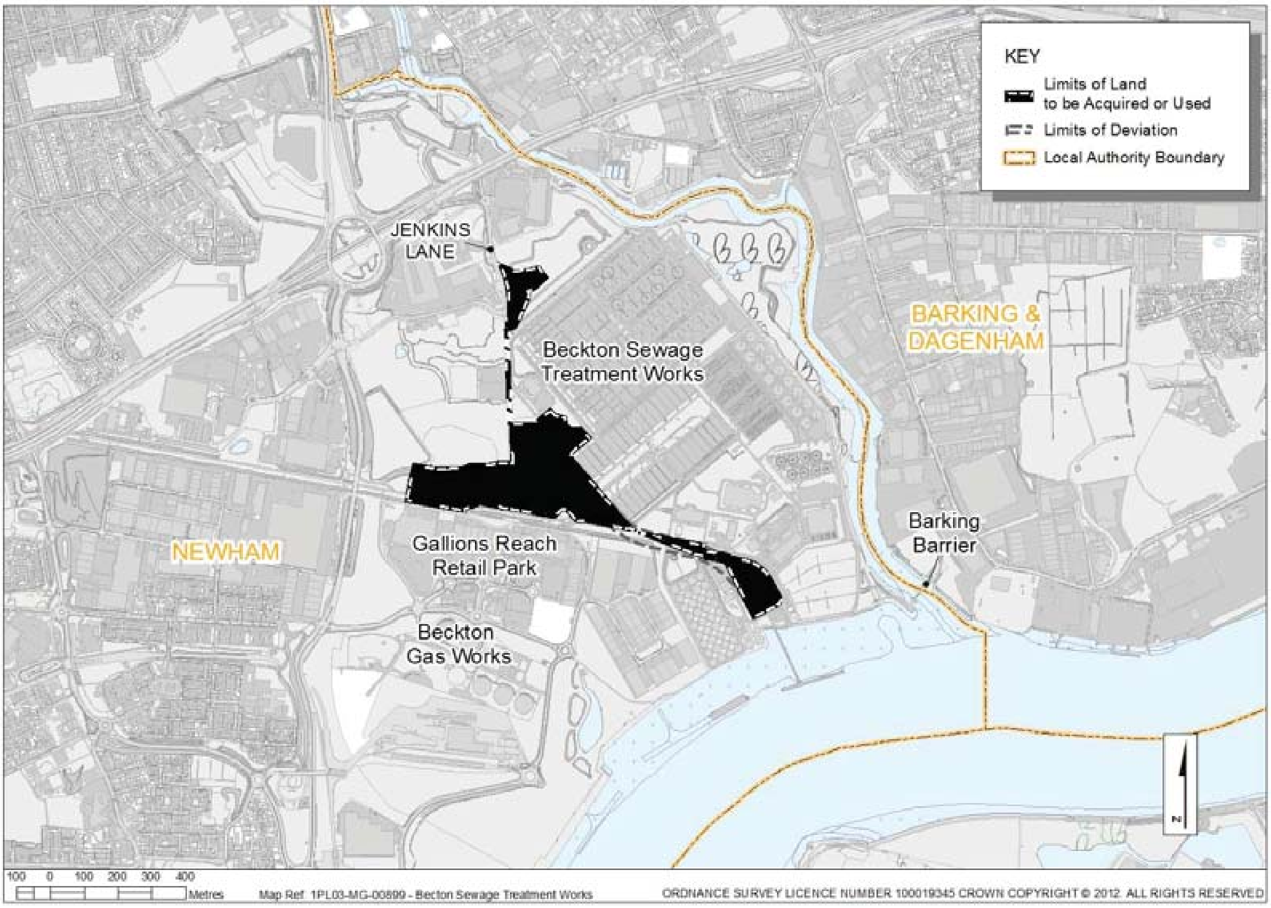
27.4.1 Further information regarding assessment of the assessment for Abbey Mills Pumping Station site can be found in Volume 25 of the *Environmental Statement*.

28 Beckton Sewage Treatment Works

28.1 Existing site context

28.1.1 Beckton Sewage Treatment Works is an existing Thames Water site located in the London Borough of Newham. The local authority boundary with the London Borough of Barking and Dagenham lies immediately to the east of the sewage treatment site.

Figure 28.1[1] Location of proposed site at Beckton Sewage Treatment Works



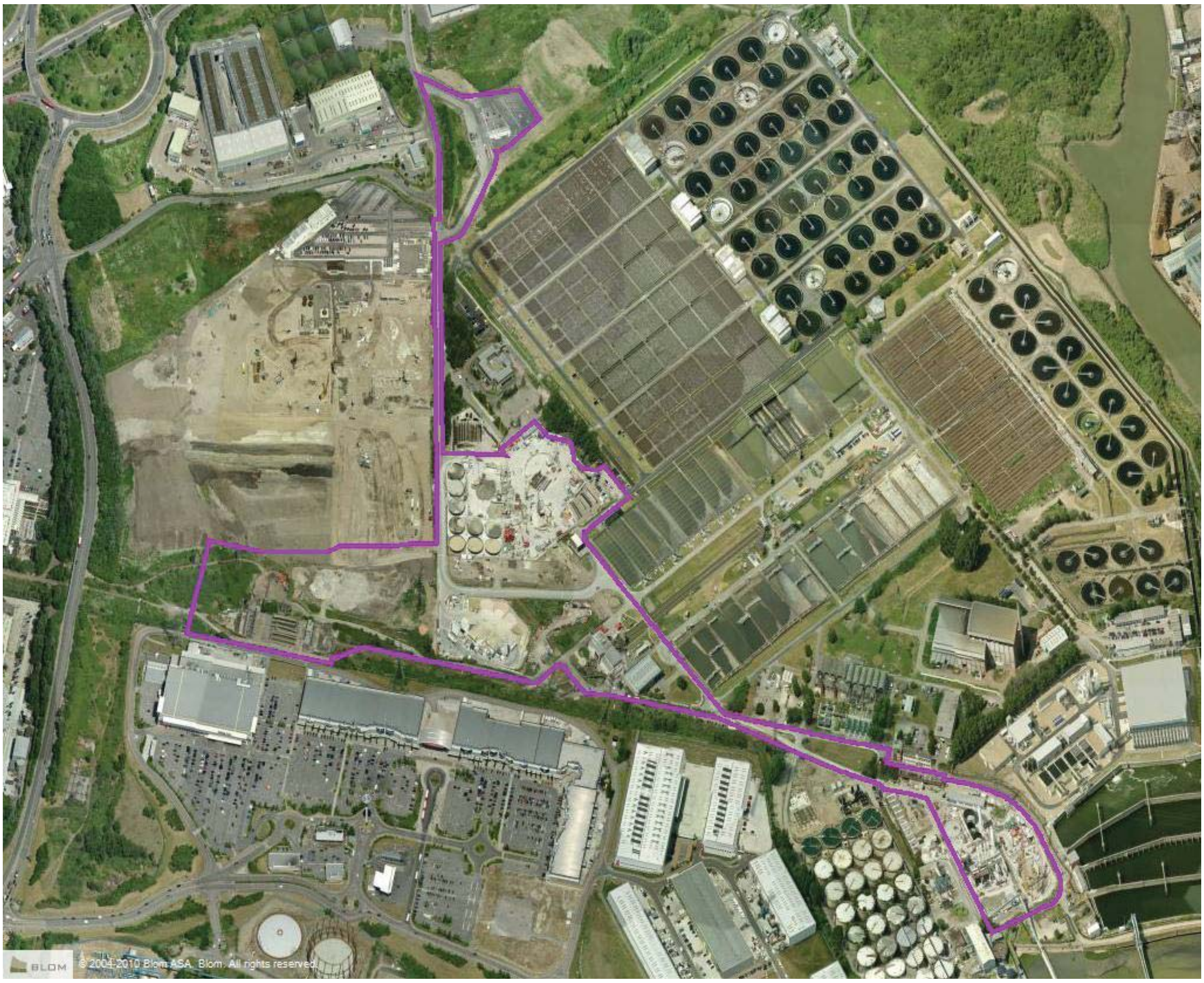
28.1.2 Existing access to the existing site is via Jenkins Lane (soon to be renamed Bazalgette Road), which joins on to the A13.

28.1.3 Beckton Sewage Treatment Works is bounded by the A13 to the north, Barking Creek to the east and the River Thames to the south. To the west and southwest there is an area of land currently being developed as an extension to the Sewage Treatment Works, along with a mixture of

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

business and retail parks. Figure 28.1 and Figure 28.2 show the site and local context.

Figure 28.2 Aerial view of existing site



28.1.4 The surrounding area is predominantly commercial and industrial. The closest commercial property is Gallons Reach Shopping Park approximately 10m south of the site.

28.1.5 The main access route to the proposed development site, the A13, falls within an air quality management designation. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

28.1.6 Both the Beckton Lands South and the Greenway and Old Ford Nature Reserve are Sites of Importance for Nature Conservation within the boundary of the proposed development site. Beckton Sewage Treatment Works Northern Settling Lagoon Site of Importance for Nature Conservation lies within the northern end of the proposed development site. The River Thames and Tidal Tributaries Sites of Importance for Nature Conservation lies to the south of the proposed development site

28.1.7 It is assumed that there would be a Grade II listed chimney located in the southern part of the proposed site. The chimney has been dismantled to enable the construction of the Lee Tunnel works and will be reinstated once construction of the Lee Tunnel is complete.

28.1.8 There are no other environmental designations on or adjacent to the site.

Figure 28.3 Beckton Sewage Treatment Works – site context

View from river northwards to Beckton Sewage Treatment Works

Outfall at Beckton

28.2 Proposed development

28.2.1 The purpose of this 15.9 hectare site would be to provide facilitates to cater for the additional flows that the Thames Tideway Tunnel would deliver, via the Lee Tunnel, to Beckton Sewage Treatment Works.

28.2.2 These facilities would include the installation of two additional pumps in the Tideway Pumping Station, currently under construction as part of the Lee Tunnel. Works would also include provision of a pipeline to allow the transfer of this increased flow from the Tideway Pumping Station to the inlet of the sewage treatment works. This flow would be treated before discharge to river. In addition two shafts and a connecting tunnel would be constructed to so that the Tideway Pumping Station could transfer any flow that exceeds the capacity of the treatment works to an overflow shaft that is currently being constructed as part of the Lee Tunnel project.

28.2.3 There are no combined sewer overflows that the main tunnel would intercept at this site.

28.2.4 Construction at the Beckton Sewage Treatment Works site is assumed to start in 2017 and be complete by 2022.

28.2.5 To construct the tunnel that is needed to transfer flows from the Tideway Pumping Station to the overflow shaft, two shafts would be constructed. The inlet shaft would be approximately 32 metres deep with an internal diameter of approximately 9 metres and the outlet shaft would be approximately 31 metres deep with an internal diameter of approximately 7 metres.

28.2.6 The tunnel (approximately 780m in length and 2.8m in diameter) connecting these shafts would be built using a tunnel boring machine. This machine would be lowered into the inlet shaft and, once underway, would travel towards the outlet shaft working 24 hours per day to help make sure that the work is completed safely, efficiently and in the least time. The tunnel boring machine would progressively excavate the ground and line the tunnel with precast concrete ‘segments’. The excavated material would be transported via the shaft to the site and removed from site as described below. The segments would be joined together to make the circular outer lining of the tunnel. When the tunnel boring machine reaches the outlet shaft it would be dismantled and removed by crane. It is then assumed that an inner lining, called a secondary lining, would be constructed by pumping wet concrete into temporary supports used to form the final inside shape of the tunnel.

28.2.7 The inlet shaft would be used to take all excavated material out of the tunnel as the tunnel boring machine progresses. It would also be used to supply precast concrete segments to the tunnel boring machine.

28.2.8 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust and ensuring safety for road users and pedestrians by controlling movement of vehicles.

28.2.9 During construction vehicles would access and egress the site from Jenkins Lane. The average peak daily number of lorry trips at this site would be 25. Excavated material arising from construction of the shafts and other structures would be transported from the site by road.

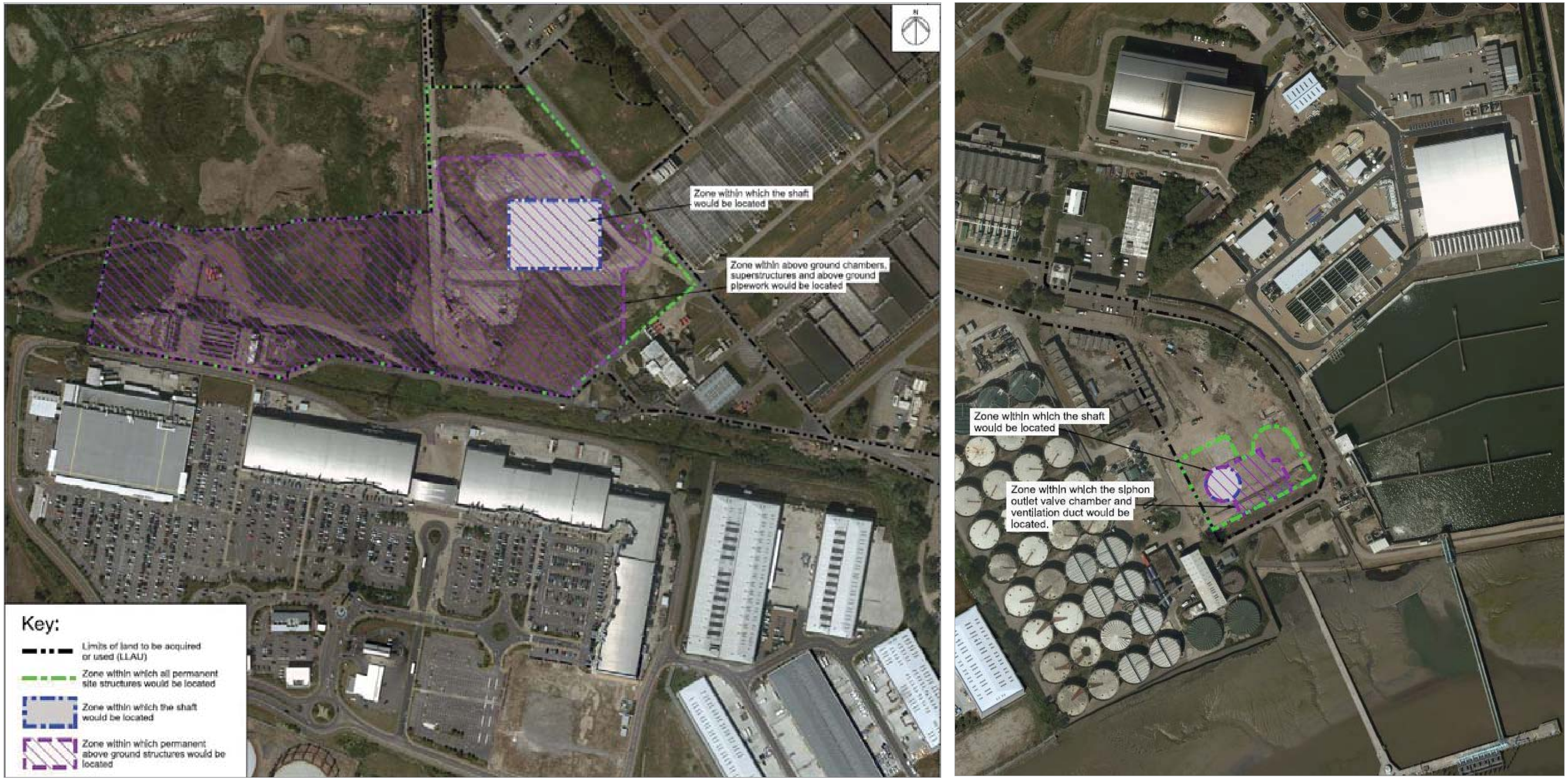
28.2.10 The plan below (Figure 28.4) shows the layout of the proposed development for which consent is sought. The plan shows a series of zones within which different components of the proposed development would be located. These zones allow some flexibility in the location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

28.2.11 While most of the structures would be underground, there would be a building of approximately 8-12 metres height located over the tunnel inlet shaft. There would also be two chambers housing equipment needed to control flow passing through the tunnel. These would be approximately 1.5 and 3.5 metres high. In addition the outlet shaft would stand approximately 3.5 metres above ground level.

28.2.12 The new structures needed to transfer flow from the Tideway Pumping Station to the existing inlet of the sewage treatment works would include a chamber of approximate height 2 to 6 metres whilst at the inlet works new grit removal plant would be installed across the existing grit channels. This plant would be approximately 5 metres above ground level. No operational lighting would be provided.

28.2.13 Once operational there would be routine inspections to the site every three to six months and more important maintenance work carried out every ten years. Access to the site would continue to be from Jenkins Lane.

Figure 28.4 Proposed development at Beckton Sewage Treatment Works site



28.3 Effects of the proposed development at Beckton Sewage Treatment Works on the environment

Introduction

28.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality and odour

b. Ecology (land based and river based)

c. Historic environment

d. Land quality

e. Transport

f. Water (surface and below ground)

g. Flood risk

28.3.2 For three topics, namely noise and vibration, socio-economics and townscape and visual, it has not necessary to carry out an assessment of construction or operational effects for the following reasons:

a. In terms of noise and vibration, there are no sensitive premises located within a distance where effects from noise and vibration would be experienced.

b. The works would be carried out entirely within the existing operational sewage treatment works within a very large industrial area and therefore there would not be significant socio-economic effects.

c. The nature of the construction work would not result in significant changes to the townscape character and viewpoints compared with the existing situation on and around the Beckton Sewage Treatment Works site.

28.3.3 The assessment of the topics listed in paragraph 28.3.1 has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. The assessment considers effects during construction and effects once the Thames Tideway Tunnel project is built and operational. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in section 4 of this non-technical summary with full details contained in Volume 2 of the *Environmental Statement*.

28.3.4 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at the Beckton Sewage Treatment Works site or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel project is built and operational. The full details for each topic are contained in Volume 26 of the *Environmental Statement.*

Effects during construction

28.3.5 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This could affect local residents and other nearby sensitive properties. However, based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on nearby properties. This is due to the small increase in pollutant concentrations predicted.

28.3.6 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. The controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

28.3.7 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that no significant transport effects would occur.

28.3.8 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up. Construction work on site would involve changes to both above ground features as well as the environment below ground.

28.3.9 Information gathering has revealed that features of interest may include evidence of medieval remains and later features of interest related to the sewage works. Given this, prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Taking this into account, no significant effects on below ground historic features are predicted.

28.3.10 Structures that are part of the Joseph Bazalgette designed Northern Outfall Sewer would need to be modified to enable a connection to be made to the new infrastructure. Any such existing features which are part of the operational Sewage Treatment Works would be documented prior to construction and so no significant effect would occur.

28.3.11 Below ground works could also give rise to land quality effects. The current condition of the land is determined by activities undertaken in the past which could result in contamination. This may in turn affect construction workers and adjacent premises. Historical and existing land uses including sewage treatment works and surrounding industrial heritage mean that there is the potential for the site to be contaminated. Workers on site would have the necessary health and safety equipment provided and adjacent premises would be protected by control measures that are used across most major construction projects. Measures to protect workers and the local area from unexploded bombs would be applied as London was heavily bombed during World War II. The effect of the possibility of the dispersal of invasive plant species, which are known to be present at this site, was also considered and control measures are included within the proposals. With the application of the measures described above, there would be no significant effects.

28.3.12 Below ground works could also have an effect on groundwater. Groundwater may be affected where a route for pollutants to enter or move within the water (commonly termed a ‘pathway’) is created, resulting in the mobilisation of pollution. Groundwater resources may also be affected as a result of the removal of substantial volumes of water from the ground during construction. At the Beckton Sewage Treatment Works site the geology is such that the below ground structures would be at a depth where groundwater would be present. Due to the geology of the site and the past land use the removal of groundwater at the site would be limited through the implementation of special construction techniques such as removing water from within the shaft as it is built, rather than from outside it. Given these measures, no significant effects on groundwater quality or resources would occur.

28.3.13 Flooding may occur from various sources, for example, tidal and river sources, as well as surface water, groundwater and sewers. Currently there is a risk of tidal, river-sourced, surface water and sewer flooding at this location. The proposed development could change the level of risk associated with all sources of flooding. However, based on the assessment there would be no change in flood risk during construction.

28.3.14 No potential impacts were identified on surface water as a result of the construction of the proposed development (the proposed construction site is not immediately adjacent to the River Thames) and so no significant effects are considered likely for the construction phase at this site.

28.3.15 Construction effects would only occur for river based ecology where construction activities take place in-river. This would not be the case at this site and therefore there would be no significant effects.

28.3.16 During construction, control measures would be in place such as noise controls and minimising light spillage to reduce the potential for impacts on land based ecology. The effects on species that use the site and immediate surrounds, including birds (such as barn owls which are known to use the site) and bats, would be minimal. Habitat lost would be replaced at the end of construction. Therefore, there would be no significant adverse effects on ecology from construction.

28.3.17 No other developments are planned nearby during the same timeframe that would interact with the construction of the project at Beckton Sewage Treatment Works and so no significant cumulative effects have been identified.

Effects during operation

28.3.18 The operational site would include connection of the new structures to the air management structures to be provided by the Lee Tunnel project to minimise any odour effects. There would be a small increase in odour associated with the proposed development but this would not be significant.

28.3.19 Groundwater levels and quality could be affected by seepage into and out of the shaft, the risk of this would be very low due to the way the shaft would be constructed. The assessment indicates that there would be no significant rise in groundwater levels related to the presence of the new structures. No significant effects on groundwater would be likely.

28.3.20 Once the development is complete, there would be an increase in discharge of treated water into the River Thames that would be equivalent to the volume of untreated sewage that would otherwise have been released at the various discharge points along the Thames. As it would have been treated, this increase would have no significant effect on surface water quality. A small increase in the spill volume of untreated sewage and the duration of the spill would be associated with the operation of the development at this site but this would not have a significant effect on water quality. No associated significant effects would occur on river based ecology.

28.3.21 The fully built project would also not alter the existing flood risks and therefore operational effects on flood risk would not be significant.

28.3.22 Routine inspections would be made every three to six months during operation, with only small numbers of vans required. This relatively minor operational activity would not lead to significant effects.

28.3.23 No other developments are planned nearby during the same timeframe that would interact with the operation of the project at the site and so no significant cumulative effects have been identified.

28.3.24 As stated in paragraph 28.3.2, significant effects are not likely during construction or operation on noise and vibration, socio-economics and townscape and visual.

28.3.25 In addition, operational effects at this site have not been assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, the assessment of air quality from traffic has not been undertaken.

b. A number of design measures would be included to prevent any contamination related to the operation of the new infrastructure at the site. The finishing of the site with an area of hard standing would prevent any site operators coming into contact with any contaminants retained below ground, and so land quality effects during operation were not assessed.

c. Operational activities would have no effect on aspects of historical interest, below or above ground, and therefore effects on the historic environment have not been assessed.

d. Given the limited area taken up by the operational site, the infrequent maintenance requirements and that the design would involve no new lighting, significant effects on land based ecology are not likely, and therefore were not assessed.

28.4 Further information

28.4.1 Further information regarding the assessment of the Beckton Sewage Treatment Works site can be found in Volume 26 of the *Environmental Statement*.

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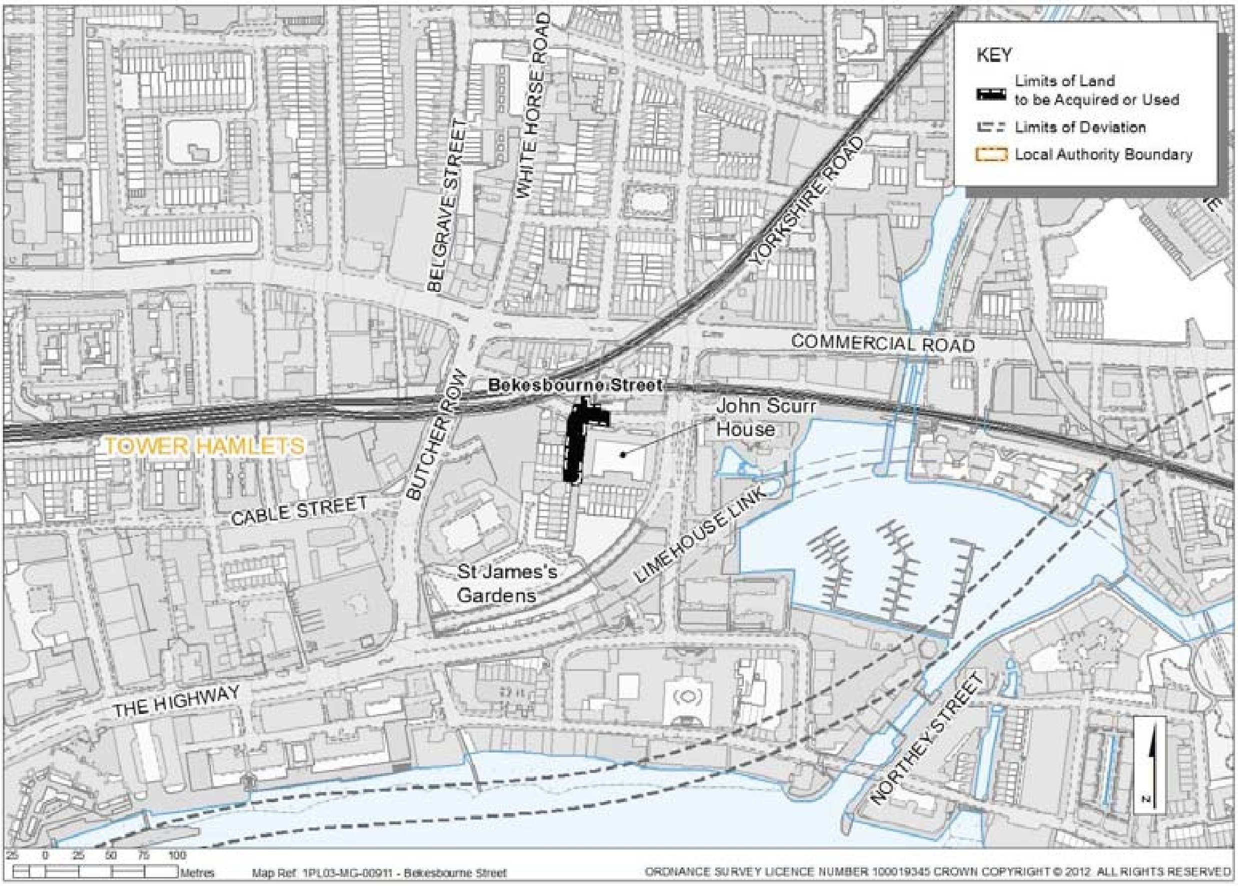
29 Minor work sites

29.1 Existing site context

29.1.1 The proposed development site comprises a section of Bekesbourne Street and its junction with Ratcliffe Lane. The site is located in the London Borough of Tower Hamlets.

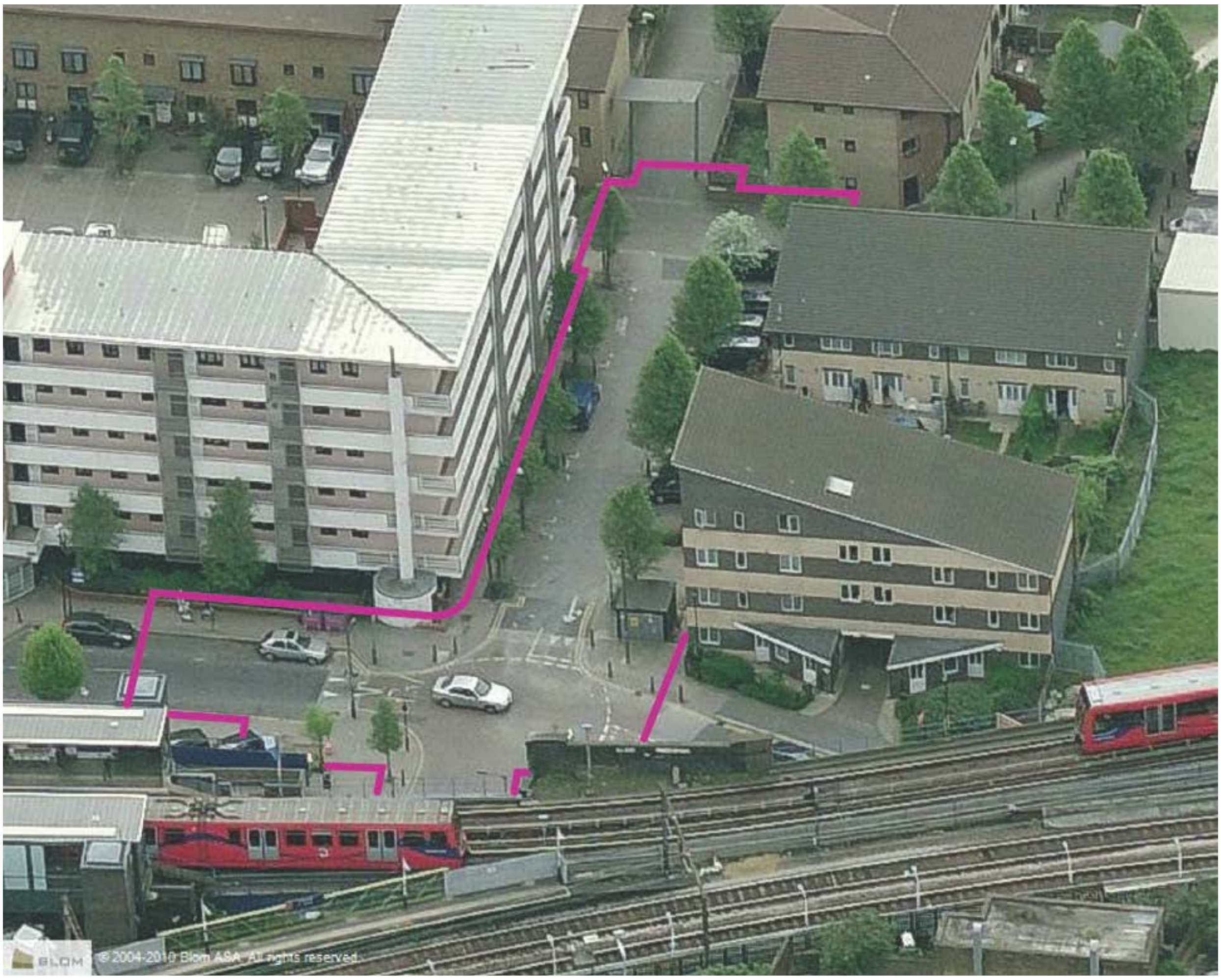
Figure 29.1[1] Location of proposed minor work sites



29.1.2 The site is bounded to the north by Limehouse Docklands Light Railway station, to the east and southeast by John Scurr House and community centre (a six storey building), and to the west and south by two to four storey housing.

[1] Section 4.7 of this non-technical summary explains the status of figures included in this and the following section.

Figure 29.2 Aerial view of existing site



29.1.3 The site is predominantly comprised of roadway with two to six storey residential dwellings and major roads surrounding the site. Figure 29.1 - Figure 29.3 show the site and local context.

29.1.4 Existing access to the site is via Ratcliffe Lane from the east and west. The site is inland, with the River Thames approximately 200m to the south.

29.1.5 An Air Quality Management Area designation has been made by the London Borough of Tower Hamlets covering the whole borough. This designation is made where pollutant levels (mainly from road vehicles) are above set standards.

29.1.6 The closest listed buildings to the site include a Grade II listed railway viaduct, located approximately 30m to the east of the site, and the grade II listed Royal Foundation of St. Katherine's Chapel located approximately 50m to the southwest of the site. Additionally, the northern end of the site, adjacent to Limehouse DLR Station, lies within the York Square Conservation Area. There are no other environmental designations on or adjacent to the site.

Figure 29.3 Bekesbourne Street – site context

View towards John Scurr Community Centre

29.2 Proposed development

29.2.1 The purpose of this 0.1 hectare site is to modify the operation of Holloway Storm Relief Sewer which currently discharges untreated sewage into the River Thames on average nine times each year, at a total volume of 7,900 cubic metres. This is equivalent to approximately three Olympic sized swimming pools.

29.2.2 Once the modifications have been undertaken, there would be approximately two discharges of untreated sewage into the River Thames per year from this site. There would be no connection to the Thames Tideway Tunnel at this site.

29.2.3 Construction at the minor works site at Bekesbourne Street is assumed to start in 2019 and be complete by 2020.

29.2.4 The proposed works at Bekesbourne Street would control discharges from the existing Holloway Storm Relief Sewer without intercepting and diverting flow to the main tunnel. Works would include the construction of a chamber underneath the street to house a gate which would control flow within the sewer. Other than in exceptional circumstances, when the residual flows would still spill to the river via the current outfall, the flows from the Holloway Storm Relief combined sewer overflow would instead be diverted to an existing sewer (the northern Low Level Sewer No.1) and be transferred to Beckton Sewage Treatment Works for treatment.

29.2.5 Excavated material arising from construction of the chamber would be transported from the site by road.

29.2.6 Construction of the chamber in Bekesbourne Street would require provision of a traffic control system. During this period, the traffic system on the section of Bekesbourne Street to the south of its junction with Ratcliffe Lane would be temporarily modified to allow vehicle movement in both directions but under traffic signal control. This would also require the temporary suspension of parking along this section of the road. Figure 29.4 below shows Bekesbourne Street and Ratcliffe Lane.

Figure 29.4 Looking north with the entrance to Limehouse Docklands Light Rail Station shown to the east

29.2.7 Work in Ratcliffe Lane would also require traffic management to maintain traffic flow.

29.2.8 All construction would be controlled to reduce potential impacts. Measures would include damping down materials and site roads to control dust, ensuring safety for road users and pedestrians by controlling movement of vehicles, and restricting working hours to limit the effects of noise on neighbours.

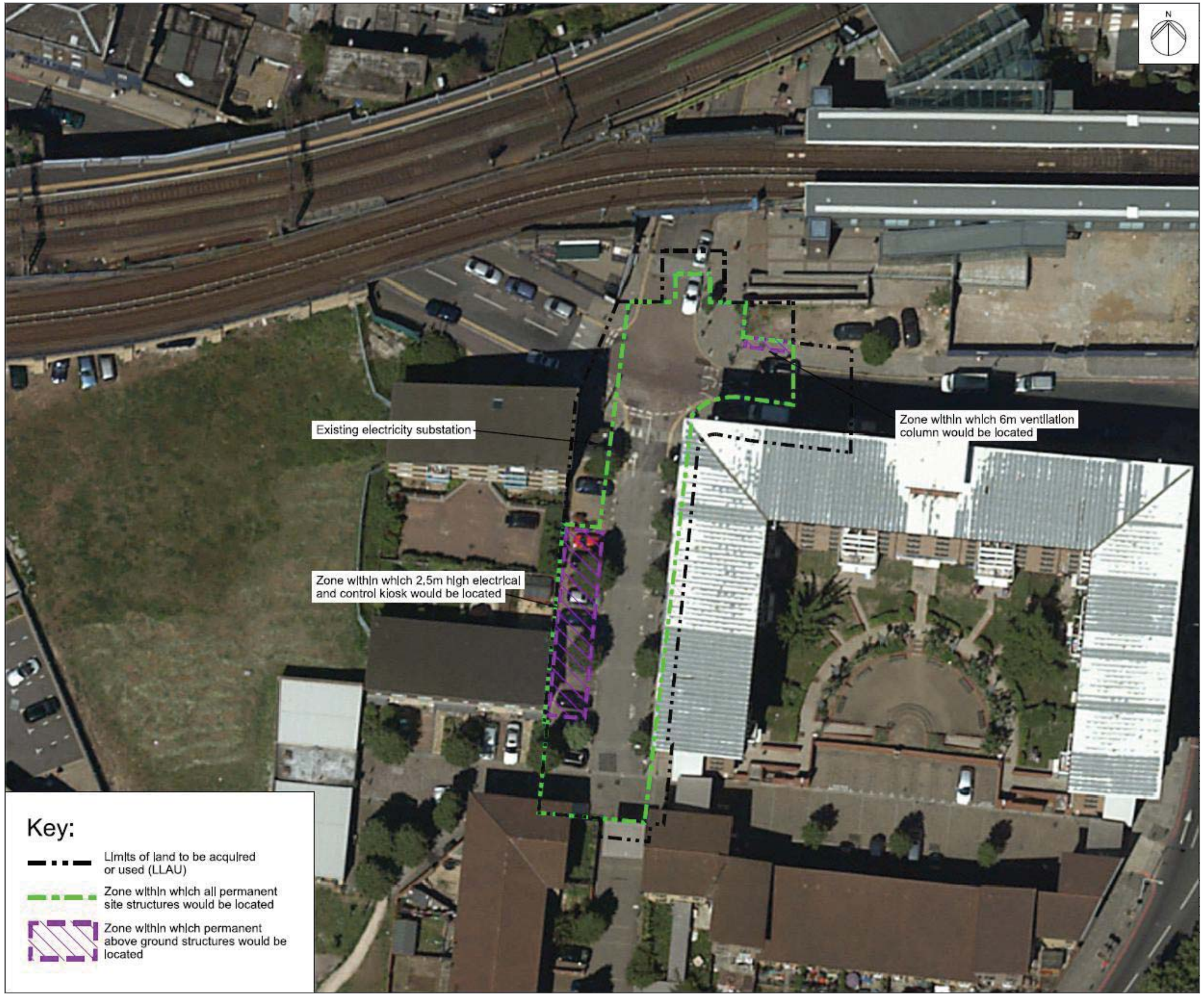
29.2.9 During construction, vehicles would access and egress the construction site from the junction of Bekesbourne Street with Ratcliffe Lane. The average peak daily number of lorry trips at this site would be five. The plan below (Figure 29.5) shows the layout of the proposed development for which consent is sought. This shows a series of zones within which the different elements of the proposed development would be located. These zones allow some flexibility in the location of the permanent works. The assessments within the *Environmental Statement* have considered the 'worst-case' location in relation to each topic to ensure that the findings are robust.

29.2.10 Most of the works would be located underground. However, the new electrical and control kiosk would be located on the west side of Bekesbourne Street in an area currently occupied by two car parking spaces. This kiosk would be approximately 2.5 metres high. A 6 metre high ventilation column would be located at the junction of Bekesbourne Street and Ratcliffe Lane. No operational lighting would be provided.

29.2.11 At an early stage in the design process, the proposed location of the kiosk was adjacent to the DLR Limehouse station to the north, but was moved to its proposed location in response to stakeholder comments.

29.2.12 Once operational, there would be routine inspections to the site every three to six months and more important maintenance work carried out every ten years. Access to the site would continue to be from Ratcliffe Lane to Bekesbourne Street.

Figure 29.5 Proposed development at Bekesbourne Street



29.3 Likely significant effects of the proposed development at Minor work sites on the environment

Introduction

29.3.1 An assessment has been undertaken for the following environmental topics:

a. Air quality
b. Ecology (river based)
c. Historic environment
d. Noise and vibration
e. Townscape and visual
f. Transport
g. Water (surface)

29.3.2 For the following topics, there would be no significant effects at this site either during construction or operation and so no assessment has been undertaken:

a. Groundwater and land quality have not been assessed because the works at the site would not be at a depth where substantial groundwater would be encountered and only a relatively small volume of soil would be excavated as part of the works and it is not thought this would have land quality effects.

b. Due to the relatively minor extent of construction at this site, there are no likely significant effects on socio-economics.

c. As there is no potential for significant effects on flood risk arising from the construction of the proposed development at Bekesbourne Street, no assessment has been undertaken. This is due to the location, limited size and extent of permanent works proposed on site that could impact flood risk.

d. Given the absence of notable species or habitats on or adjacent to the site, no significant effects on terrestrial ecology are anticipated.

29.3.3 The assessment of each topic has involved gathering information about existing environmental conditions, reviewing the proposed development at the site and then undertaking an assessment of the likely significant effects of the proposals on the environment. Subject to the outcome of this process, the design has been modified to reduce effects as far as practicable. More information on the method for carrying out the assessments is given in Section 4 of this non-technical summary, with full details contained in Volume 2 of the *Environmental Statement*.

29.3.4 The following section summarises the likely significant effects (both beneficial and adverse) arising from the proposed development at Bekesbourne Street or explains where effects are not likely to be significant. Effects during construction are presented first, followed by effects once the Thames Tideway Tunnel project is built and operational. The full details for each topic are contained in Volume 27 of the *Environmental Statement*.

Effects during construction

29.3.5 During construction, there may be an increase in pollutants that affect air quality from vehicles that are used to move materials and equipment for the project. Pollutants may also be released from the equipment that would be used for construction. This increase in pollutants could affect local residents and other nearby sensitive properties. Pollutant levels are currently high across the London Borough of Tower Hamlets. However, it is predicted that there will be ongoing improvements in background air quality attributable to improvements in vehicle technology over the coming years. Based on computer modelling, it is predicted that pollutants associated with construction works would not result in a significant effect on the majority of local residents or other nearby sensitive properties. There would however be a significant adverse air quality effect on a residential property on Bekesbourne Street, adjacent to the site boundary. This would be due to the proximity of this receptor to the construction works. However, it is noted that pollution levels would still be lower than they are at present.

29.3.6 An issue which is common to most construction sites is how dust would be controlled from sources such as demolition, materials stored on site being blown around and vehicles which could carry out dirt onto local roads which may then create dust when disturbed by other vehicles. Controls that would be applied during construction include dust suppression measures. Based on the application of these measures, there are not likely to be significant effects from construction dust. No source of odour has been identified for the construction phase of the project.

29.3.7 Noise could arise from construction activities including the movement of large vehicles and noise from equipment used on site. The extra vehicles associated with the construction would result in a small increase in future traffic levels however this would not result in a significant increase in noise. Conversely, significant adverse noise effects are expected at John Scurr House as a result of noise from construction plant on the site. Residents of John Scurr House may be eligible for noise insulation set out in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy*. Should the affected residents choose to take up the offer of noise insulation, the construction noise effects would be reduced, and would then be considered not significant. No significant effects are predicted elsewhere in respect of construction noise.

29.3.8 Vibration related to construction activity can affect nearby properties and their residents and occupiers. The predicted vibration levels during construction are low in terms of effects on residents and occupiers, and below the levels likely to cause human disturbance or cosmetic building damage. Vibration effects would therefore not be significant.

29.3.9 Due to the removal of trees and parking bays, the installation of hoardings and welfare facilities, and the presence of construction activity and plant, there is likely to be a significant adverse effect on the townscape character of the site. Significant effects on townscape beyond the site are not likely.

29.3.10 A significant adverse effect has been predicted on one residential viewpoint, which is largely due to the removal of trees and the visibility of construction plant. No significant effects are expected on any other residential, recreational or transport related viewpoints as the visibility of the construction works would only be present in the background, or be filtered by street trees.

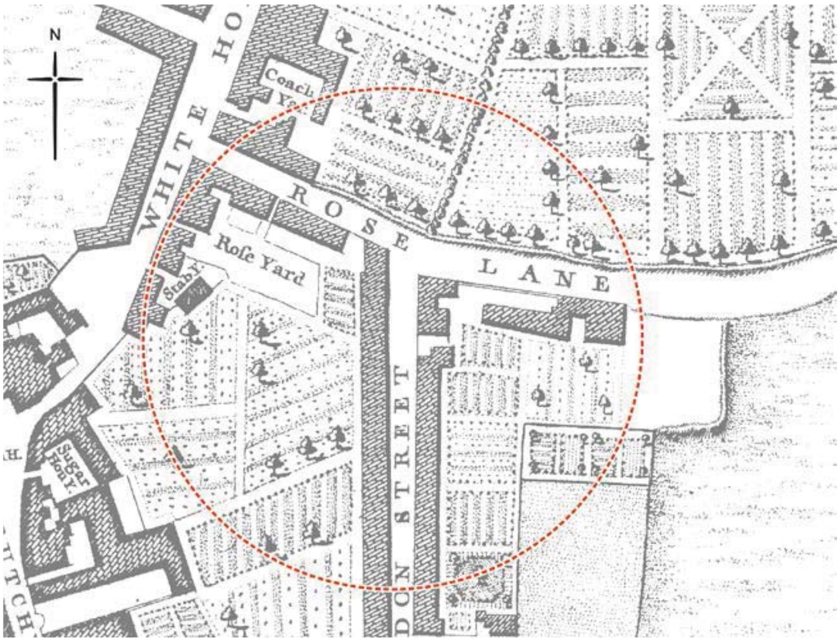
29.3.11 The measures proposed as part of the project to minimise disruption and ensure safety of road users and pedestrians would ensure that significant transport effects are minimised. The change in pedestrian routing and removal of resident and visitor parking spaces along Bekesbourne Street is deemed likely to have a significant adverse effect on both pedestrians and parking users.

29.3.12 Through a study of historical maps, previous archaeological records and research into local history, a picture of the possible below ground remains has been built up (Figure 29.6). Construction work would involve changes to both above ground features as well as the environment below ground.

29.3.13 Information gathering has revealed that the site generally has uncertain or low potential to contain buried heritage, although there is high potential for buried 18th–19th century footings of earlier buildings. Given this, archaeologists would be present on site to observe construction and to record any features of interest. Therefore, no significant effects on below ground historic features are predicted.

29.3.14 There are no above-ground features of historic significance within the site and therefore no significant effects.

Figure 29.6 Rocque's map of 1746



29.3.15 While the minor works site at Bekesbourne Street lies inland, construction activity could affect water quality in the River Thames through rainfall carrying pollution from the site to the river. However, with the proposed construction practices in place to minimise the risk of pollution, no significant effects are predicted.

29.3.16 No other developments are planned nearby during the same timeframe that would interact with the construction work at Bekesbourne Street and so no significant cumulative effects have been identified.

Effects during operation

29.3.17 Noise and vibration from operational plant, maintenance activities, as well as from operational traffic has been considered. There would be no mechanical ventilation plant that could generate noise at this site. Noise from minor plant equipment (for example, plant within the electrical and control kiosk) would be minimised by technology included in the design, and therefore there would be no significant effect from noise from this source. During maintenance visits there would be very low numbers of vehicles required and minimal noise from maintenance equipment. As a result no significant noise and vibration effects are likely from maintenance activities.

29.3.18 Maintenance and routine inspections would be made every three to six months during operation, with only very small numbers vans required for visits. During more substantial maintenance activities, which would occur approximately once every ten years, larger vehicles would require short-term temporary parking restrictions on adjacent roads to allow safe access to the site (Figure 29.7). This relatively minor operational activity would not lead to significant effects.

Figure 29.7 View from Ratcliffe Lane towards junction with Bekesbourne Street

29.3.19 The proposed development at Bekesbourne Street would control discharges from the Holloway Storm Relief sewer and so reduce the frequency, duration and volume of spills. As a result, there would be significant beneficial effects on water quality in the River Thames due to the reduction in spills, as well as the decrease in bacteria and sewage litter associated with the discharges. Associated with the improvement in water quality, would be beneficial effects on the river-based ecology, although effects would not be significant at the site specific level at this location.

29.3.20 No other developments are planned nearby during the same timeframe that would interact with the operation of the project at the site and so no significant cumulative effects have been identified.

29.3.21 As well as the topics listed in paragraph 29.3.1, operational effects at this site have not been assessed for the following topics:

a. Due to the very small number of vehicle movements associated with the operation of the site, an assessment of air quality from traffic has not been undertaken.

b. As the site would not be connected to the main tunnel, no significant effects from odour are predicted.

c. Townscape and visual has not been assessed on the basis that the site would be reinstated and above-ground structures would be relatively small in size and height and so there would not be any significant effect.

d. Operational activities would also have no effect on aspects of historical interest, below or above ground and therefore effects on historic environment have not been assessed.

29.4 Further information

29.4.1 Further information regarding the assessment of the Bekesbourne Street minor works site can be found in Volume 27 of the *Environmental Statement*.

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30 Summary of significant effects across all sites

30.1 Introduction

30.1.1 This section summarises significant effects across all Thames Tideway Tunnel sites. This information is already presented in Sections 6 to 29 and therefore this section does not introduce additional effects. Project-wide effects are presented in Section 5 only.

30.1.2 For land quality, groundwater and flood risk, no significant effects are anticipated at any of the 24 proposed Thames Tideway Tunnel sites.

30.2 Air quality and odour

30.2.1 Significant beneficial effects are predicted at the relocated vessels at the Victoria Embankment Foreshore and Blackfriars Bridge Foreshore sites. This is a result of the new locations being further from major roads than where they are currently located.

30.2.2 Significant adverse effects are predicted at residential properties adjacent to the Shad Thames Pumping Station site and at the minor works site on Bekesbourne Street. It is not possible to propose any site-specific mitigation measures to address these effects as there is already a commitment to best practice emission limits (see *Code of Construction Practice*).

30.2.3 At all other sites and with the implementation of the measures set out in the *Code of Construction Practice* to minimise effects on local air quality and dust, no significant adverse effects are predicted during construction.

30.2.4 No significant odour effects would be likely during the operation of the Thames Tideway Tunnel project. Odour would be controlled at all sites through the ventilation design, which includes ventilation columns and odour control equipment (such as carbon filters), in order to minimise effects on surrounding properties.

30.3 Ecology (river)

30.3.1 Significant adverse effects on river based ecology would be likely at foreshore sites due to the loss of habitat during both construction and operation. There would also be disturbance during construction. At Abbey Mills there would be temporary significant adverse effects during construction when the Lee Tunnel is taken out of operation for a period of up to 44 weeks and combined sewer discharges to the River Lee would resume during this period.

30.3.2 Significant beneficial effects would be likely once the Thames Tideway Tunnel is operational. This is due to a reduction in the occurrence of dissolved oxygen related fish mortalities, an increase in the distribution of pollution sensitive fish species and an improvement in the quality of foraging habitat in the vicinity of most combined sewer overflow interception sites.

30.3.3 The inland site at Acton Storm Tanks would intercept the Acton Storm Relief outfall. Once operational, this interception would result in a significant benefit on foreshore habitat utilised by rare invertebrates (the 2 lipped door snail and the German hairy snail which are known to occur in the area).

30.3.4 At Dormay Street, there would be significant beneficial effects due to the creation of new intertidal habitat which would provide a feeding, resting and nursery habitat for fish.

30.4 Ecology (land)

30.4.1 Significant beneficial effects are likely at the following sites:

a. Acton Storm Tanks

b. Hammersmith Pumping Station

c. Barn Elms

d. Carnwath Road Riverside

e. Falconbrook Pumping Station

f. Abbey Mills Pumping Station.

30.4.2 This is due to the inclusion of proposed ecological features such as bird and bat boxes which would increase local populations of these species.

30.5 Historic environment

30.5.1 Significant adverse effects predicted on the historic environment vary from site to site, but include effects on the historic setting of heritage assets, and physical effects. Physical effects on above ground heritage could arise from the complete or partial removal of structures, either temporarily or permanently. Effects could also arise from ground movement associated with the tunnel and other deep excavations, with significant adverse effects predicted at Greenwich Pumping Station, Lots Road Pumping Station at Cremorne Wharf Depot and the Embankment wall at Victoria Embankment Foreshore. Physical effects on buried archaeology could arise from removal of archaeological deposits for the construction of below ground infrastructure.

30.5.2 Effects from settlement would be mitigated through a programme of monitoring, with any damage to heritage features repaired using appropriate conservation methods.

30.5.3 Prior to or during construction, a programme of archaeological investigation would take place to record any features of interest. Therefore, no significant effects on below ground historic features are predicted following mitigation.

30.5.4 Significant adverse effects during construction would remain only where there would be removal of whole or substantial parts of a heritage feature, or an effect on historic setting, namely at:

a. Putney Embankment Foreshore
b. Carnwath Road Riverside
c. Chelsea Embankment Foreshore
d. Albert Embankment Foreshore
e. Victoria Embankment Foreshore
f. Blackfriars Bridge Foreshore
g. King Edward Memorial Park Foreshore
h. Deptford Church Street
i. Shad Thames Pumping Station.

30.5.5 Significant adverse effects on the setting of heritage assets during operation have been identified at Blackfriars Bridge Foreshore and Chelsea Embankment Foreshore.

30.5.6 Once operational, there would be significant improvements on the setting of heritage assets at Chelsea Embankment Foreshore, Carnwath Road Riverside, Deptford Church Street and King Edward Memorial Park.

30.6 Noise and vibration

30.6.1 Significant adverse noise and/or vibration effects have been identified at 14 sites as a result of construction activities as follows:

a. Hammersmith Pumping Station (noise)
b. Barn Elms (noise)
c. Putney Embankment Foreshore (noise)
d. Cremorne Wharf Depot (noise)
e. Kirtling Street (noise)
f. Heathwall Pumping Station (noise)
g. Albert Embankment Foreshore (noise and vibration)
h. Victoria Embankment Foreshore (noise)
i. Shad Thames Pumping Station (noise and vibration)
j. Chambers Wharf (noise and vibration)
k. King Edward Memorial Park Foreshore (noise and vibration)
l. Earl Pumping Station (noise and vibration)
m. Deptford Church Street (noise)
n. minor works site Bekesbourne Street (noise).

30.6.2 Where significant adverse effects are identified, property owners may be eligible to apply for compensation through the *Thames Tideway Tunnel* *compensation programme*. However, since it cannot be guaranteed that the compensation measures would be accepted by the relevant property owners, the residual effect assessments do not take the compensation measures into account and residual significant effects are still predicted at 14 sites.

30.6.3 No significant negative noise and vibration effects are predicted at any site during the operation of the Thames Tideway Tunnel.

30.7 Socio-economics

30.7.1 Significant adverse construction effects on socio-economics have been identified at 11 sites:

a. Hammersmith Pumping Station
b. Barn Elms
c. Putney Embankment Foreshore
d. Carnwath Road Riverside
e. Cremorne Wharf Depot
f. Kirtling Street
g. Victoria Embankment Foreshore
h. Chambers Wharf
i. King Edward Memorial Park Foreshore
j. Earl Pumping Station
k. Deptford Church Street.

30.7.2 In most cases this is due to effects on amenity, which includes consideration of noise effects. In some cases, the displacement of business or facilities, or a reduction or loss of open space would contribute to significant adverse effects.

30.7.3 There would be significant beneficial operational effects at Carnwath Road Riverside, Blackfriars Bridge Foreshore and King Edward Memorial Park Foreshore due to an increase in public amenity space. Elsewhere, operational effects would not be significant.

30.8 Townscape and visual amenity

30.8.1 Significant adverse townscape and visual effects during construction have been identified at most sites as a result of the long duration and high visibility of construction activities. As far as practicable, measures have been incorporated into the *Code of Construction Practice* to address these effects. At King Edward Memorial Park, mitigation through advance planting would help reduce adverse effects. However, for the majority of sites, no further measures are possible due to the highly visible nature of the construction works.

30.8.2 Once operational, there would be a significant adverse effect at Chelsea Embankment due to the high visibility of the proposed foreshore structure located within a sensitive stretch of the River Thames.

30.8.3 Significant beneficial effects have been identified at the following sites once the Thames Tideway Tunnel is operational:

a. Acton Storm Tanks
b. Carnwath Road Riverside
c. Falconbrook Pumping Station
d. Heathwall Pumping Station.
e. Albert Embankment Foreshore,
f. Chambers Wharf
g. King Edward Memorial Park Foreshore
h. Earl Pumping Station
i. Deptford Church Street.

30.8.4 This would result from enhancement to the area through the proposed development including landscaping and high quality design.

30.9 Transport

30.9.1 Significant adverse transport effects during construction have been identified at nine sites:

a. Acton Storm Tanks
b. Putney Embankment Foreshore
c. Chelsea Embankment Foreshore
d. Kirtling Street
e. Albert Embankment Foreshore
f. Victoria Embankment Foreshore
g. Blackfriars Bridge Foreshore
h. Deptford Church Street
i. minor works site Bekesbourne Street.

30.9.2 These effects vary and include effects on pedestrians and cyclists, on-street parking, coaches and service vehicle. No significant effects on network capacity or junction operation are predicted.

30.9.3 During the operation of the Thames Tideway Tunnel, no significant adverse transport effects are predicted. This is due to maintenance visits to the Thames Tideway Tunnel sites being infrequent, short-term and localised.

30.10 Water resources – surface water

30.10.1 Significant beneficial effects on surface water resources have been identified at all sites where the combined sewer overflow would be intercepted. The operation of the Thames Tideway Tunnel project would improve water quality by reducing pollutant loading through the reduction of combined sewer overflow spill frequency, duration and volume along the tidal Thames.

30.10.2 No significant adverse effects either during construction or operation are anticipated as a result of the Thames Tideway Tunnel and so no mitigation measures are required.

30.11 Further information

30.11.1 Further information regarding the summary of significant effects across all sites can be found in Volume 3 of the *Environmental Statement*.

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