**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

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

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# Thames Tideway Tunnel

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### Section 1: Introduction

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# 1 Introduction

1.1.1 This volume of the *Environmental Statement* of the Thames Tideway Tunnel project presents the results of the environmental impact assessment (EIA) of the proposed development at the Earl Pumping site.

1.1.2 The proposal at this site is to intercept the existing Earl Pumping Station combined sewer overflow (CSO), which currently discharges approximately 26 times in a typical year. The total volume is approximately 539,000m$^3$ each year. A CSO drop shaft would divert the flows into the proposed Greenwich connection tunnel which would in turn transfer the flows into the main tunnel at Chambers Wharf.

1.1.3 The site and environmental context are described in Section 2. The proposed development, comprising both the construction and operational phases, is described in Section 3. Those elements of the proposal for which development consent is sought are described followed by a description of the assumptions applied to the assessment of construction and operational effects. Finally in Section 3.6, the main alternatives which have been considered for this site are presented.

1.1.4 Sections 4 to 15 present the environmental assessments for each topic, which are presented alphabetically. The order of these topics and the structure of each assessment remains the same across different sites.

1.1.5 Figures and appendices for this site are appended separately (see Vol 22 Earl Pumping Station figures and Vol 22 Earl Pumping Station appendices). In addition, there is a separate glossary and abbreviations document which explains technical terms used within this assessment.

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## Volume 22: Earl Pumping Station site assessment

### Section 2: Site context

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# 2 Site context

2.1.1 The majority of the proposed development site is located within the London Borough (LB) of Lewisham with a small section of the site along the north and west falling within the LB of Southwark. The site comprises the Thames Water Earl Pumping Station and adjacent industrial land. The site extent is defined by the limits of land to be acquired or used (LLAU) and covers an area of approximately 0.6 hectares. The site context and location is shown in Vol 22 Figure 2.1.1 (see separate volume of figures). The CSO currently discharges into the River Thames approximately 600m to the east of the Earl Pumping Station site. The CSO discharge point, lies on the LB of Lewisham and LB of Southwark boundary.

2.1.2 The site is bounded to the north by Chilton Grove and to the east by Yeoman Street. 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 first 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. The surrounding area is predominantly industrial to the south and east, and housing to the west and north. Vol 22 Plate 2.1.1 below provides an aerial view of the site. The River Thames lies approximately 600m to the east of the site.

**Vol 22 Plate 2.1.1 Earl Pumping Station – aerial photograph**


2.1.3 The site comprises hardstanding and buildings, including the existing pumping station in the north part of the site and a depot, weighbridge and offices in the southern section of the site. The general pattern of existing land uses within and around the site is shown in Vol 22 Figure 2.1.2 (see separate volume of figures).

2.1.4 Existing access to the site is from Chilton Grove to the north (see Vol 22 Plate 2.1.2 below) and Yeoman Street to the east, via Plough Way and Lower Road (A200). The closest railway station is the Surrey Quays Overground station located approximately 750m walking distance to the northwest of the site and the nearest bus stop is the Yeoman Street bus stop on Plough Way (B206). There are no public rights of way (PRoW) on or near to the site.

**Vol 22 Plate 2.1.2 Earl Pumping Station (to the right) looking east along Chilton Grove**


2.1.5 There are a number of receptors in close proximity to the site and these include residential, commercial and recreational receptors as follows (approximate closest distance to the proposed main site hoarding is given):

a. Residential:

   i properties on Croft Street - adjacent to the southern hoarding boundary

   ii properties on Croft Street - on the western side of Croft Street

   iii properties on Chilton Grove - on the northern side of Chilton Grove, opposite Earl Pumping Station

b. Commercial:

i General industrial storage and distribution – adjacent to the southeast hoarding boundary

c. Recreational:

i Surrey docks water sports centre – 180m to the north

ii Theodorous south dock marina – 180m to the northeast

2.1.6 Environmental designations for the site and immediate surrounds are shown in Volume 22 Figure 2.1.3 (see separate volume of figures)

2.1.7 The site lies entirely within two air quality management areas (AQMA). The majority of the site lies within the Lewisham AQMA. The area of the site which lies within the LB of Southwark (the northern side of Chilton Grove) is part of the Southwark AQMA. Both the Lewisham and Southwark AQMAs are declared for nitrogen dioxide ($NO_2$) and particulate matter ($PM_{10}$).

2.1.8 The site is not within an area designated for nature conservation; however, there are three Sites of Importance for Nature Conservation (SINCs) within 600m of the site. These include: Greenland Dock SINC, River Thames and Tidal Tributaries SINC (Grade M) and Rainsborough Avenue Embankments SINC.

2.1.9 There are no listed buildings on or adjacent to the site.

2.1.10 There are also no conservation area designations applicable to the site; however, the site lies within the northern part of an archaeological priority area, which extends from Deptford to include The Strand, Sayes Court, and the Royal Naval Dockyard.

2.1.11 There are no tree preservation orders (TPOs) in effect on or adjacent to the site.

2.1.12 Land quality at the site is influenced by a number of historical land uses including asphalt works and tar works and the present use as a pumping station. Local geology comprises superficial deposits and Made Ground, River Terrace Deposits (secondary aquifer), Thanet Sand, and Chalk at depth (principal aquifer).

2.1.13 The site is located within the defended tidal Flood Zone 3 (1 in 100 year event) of the River Thames.

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## Volume 22: Earl Pumping Station site assessment

### Section 3: Proposed development

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# 3 Proposed development

## 3.1 Overview

3.1.1 The proposed development at Earl Pumping Station would be a CSO interception site. A CSO drop shaft would be constructed, which would be online with the proposed Greenwich connection tunnel. In order to intercept the existing Earl Pumping Station CSO the development would also include an interception chamber, hydraulic structures/chambers with access cover(s). Other structures would include culverts to modify, connect, control, ventilate, access and intercept flows from the existing Earl Pumping Station CSO and divert them into the Greenwich connection tunnel.

3.1.2 The geographic extent of the proposals for which development consent is sought, is defined by the limits of land to be acquired or used (LLAU).

3.1.3 This section of the assessment provides a description of the proposed development. The defined project for which consent is sought is described in Section 3.2. In Section 3.3, assumptions are presented on how the development at this site is likely to be constructed and include the assumed programme and typical construction activities. Section 3.4 sets out operational assumptions in terms of operational structures and typical maintenance regime. These construction and operational assumptions underpin the assessment.

3.1.4 Other developments may become operational in advance of or during the Thames Tideway Tunnel project thereby changing the baseline conditions. In order to undertake an accurate assessment it is necessary to compare the predicted situation with the Thames Tideway Tunnel project in place with this future baseline conditions ('base case') (rather than comparing it with the current conditions). In addition, other developments may be under construction at the same time as construction or operation of the Thames Tideway Tunnel project and this could lead to cumulative effects. Information regarding schemes included in the base case and in the cumulative assessment is summarised in Section 3.5 with details included in Vol 22 Appendix N. The methodology for identifying these schemes is explained in Vol 2 Section 3.8. Finally, Section 3.6 describes any on-site alternatives considered.

## 3.2 Defined project

3.2.1 This section identifies the proposals for which consent is sought and so those which can be regarded, subject to approval, as being "certain" or nearly so (eg, indicative locations).

3.2.2 Vol 22 Table 3.2.1 below, sets out the documents and plans for which consent is sought and which have been assessed.

**Vol 22 Table 3.2.1 Earl Pumping Station – plans and documents defining the proposed development**

| Document/plan title | Status | Location |
|---|---|---|
| Proposed Schedule of Works | For approval | Schedule 1 of *The Draft Thames Water Utilities Limited (Thames Tideway Tunnel) Development Consent Order 201[ ] (Draft DCO)* (and extracts below) |
| Site works parameter plan | For approval | Vol 22 Earl Pumping Station figures – Section 1 |
| Demolition and site clearance plan | For approval | Vol 22 Earl Pumping Station figures – Section 1 |
| Access plan | For approval | Vol 22 Earl Pumping Station figures – Section 1 |
| Landscape plan | Illustrative only -but scale of above ground structures indicative | Vol 22 Earl Pumping Station figures – Section 1 |
| *Design Principles: Generic* | For approval | *Design Principles* report Section 3 (see Vol 1 Appendix B) |
| *Design Principles: Site specific principles* (Earl Pumping Station) | For approval | *Design Principles* report Section 4.18 (see Vol 1 Appendix B) |
| *Code of Construction Practice (CoCP)* Part A: General Requirements | For approval | *CoCP* Part A (see Vol 1 Appendix A) |
| *Code of Construction Practice (CoCP)* Part B: Site-specific Requirements (Earl Pumping Station) | For approval | *CoCP* Part B Earl Pumping Station (see Vol 1 Appendix A) |

## Description of the proposed works

3.2.1 Schedule 1 to the *Draft DCO* describes the proposed works for which development consent is sought. The schedule describes the main tunnel, connection tunnels and also the works which would be required at each of the proposed sites within the project. This includes the works comprising the NSIP and associated development (which are described in Part 1 of

Schedule 1) and ancillary works (which are described in Part 2 of Schedule 1).

3.2.2 The following sections provide a description of the proposed works at this site under three headings: Nationally significant infrastructure project, Associated development and Ancillary works. The description of the proposed works has been taken from Schedule 1 to the *Draft DCO* and the codes given for the works are those given within that schedule.

3.2.3 In accordance with the *Draft DCO*, all distances, directions and lengths referred to are approximate. All distances for scheduled linear works referred to are measured along the centre line of the limit of deviation for that work. Internal diameters for tunnels and shafts are the approximate internal dimensions after the construction of a tunnel lining. Unless otherwise stated, depths are specified to invert level and are measured from the proposed final ground level.

### Nationally significant infrastructure project

3.2.4 The proposed structures and works required at this site which comprise the nationally significant infrastructure project are as follows:

a. **Work No. 21a:** Earl Pumping Station CSO drop shaft – A shaft with an internal diameter of 17 metres (which extends 3 metres above the proposed ground level) and which has a depth (to invert level) of 51 metres (measured from the top of Work No. 21a).

### Associated development

3.2.5 The proposed structures and works required at this site which comprise the associated development are as follows:

a. **Work No. 21b**: Earl Pumping Station associated development – Works to intercept and divert flow from the Earl Pumping Station CSO to the Earl Pumping Station CSO drop shaft (Work No. 21a) and into the Greenwich connection tunnel (Work No. 20) including the following above and below ground works and structures:

   i demolition of existing industrial buildings and office building and associated structures, weighbridge and other structures including boundary wall, and ground preparation works including land remediation

   ii construction of an interception chamber, hydraulic structures, chambers with access covers and other structures including culverts, pipes and ducts to modify, connect, control, ventilate, de-aerate, and intercept flow

   iii construction of brown roof and parapet wall over the top of Work No. 21a

   iv construction of structures for air management plant and equipment and associated ducts and chambers on top of Work No. 21a

   v construction of other structures for air management plant and equipment including filters and ventilation columns and associated below ground ducts and chambers vi construction of pits, chambers, ducts and pipes for cables, hydraulic pipelines, utility connections, utility diversions and drainage, including facilities for drainage attenuation

vii provision of new construction access from Yeoman Street and subsequent reinstatement of original highway layout

viii construction of a temporary and then permanent access from Croft Street

ix modification of existing access on Chilton Grove.

3.2.6 The maximum heights of above ground structures, which are for approval, and shown on the Site works parameter plan (see separate volume of figures – Section 1) are as follows:

a. Ventilation column(s) serving the interception chamber = 6.0m

b. Interception and valve chambers = 4.0m

c. Drop shaft (parapet) = 5.0m

d. Ventilation structure(s) over shaft = 7.0m

e. Ventilation column(s) serving the interception chamber = 6.0m (minimum = 5.0m)

f. Ventilation column(s) serving the shaft = 8.0m (minimum 4.75m)

3.2.7 In addition, further works are required at this site that constitute associated development within the meaning of section 115(2) of the Planning Act 2008. These comprise:

a. establishment of temporary construction areas at each works site to include, as necessary, site hoardings/means of enclosure, demolition (including of existing walls, fences, planters, and other buildings and other above and below ground structures), provision of services, including telecommunications, water and power supplies (including substations) including means of enclosure, and ground preparation works including land remediation and groundwater de-watering

b. provision of welfare/office accommodation, workshops and stores, storage and handling areas, facilities for and equipment for processing of excavated materials, treatment enclosures and other temporary facilities, plant, cranes, machinery, temporary bridges and accesses, and any other temporary works required

c. in connection with Work Nos. 5, 6, [8] , 11, 12, 13, 14, 15, 16, 17, 19, [23], 24 [and 26] the provision of temporary moorings (including dolphins) and other equipment and facilities for temporary use by barges, pontoons and other floating structures and apparatus (including as necessary piling for support of such structures) for use in construction of those works, and works for the strengthening of river walls and other flood protection defences

d. temporary removal of coach and car parking bays and creation of temporary replacement coach and car-parking as required and temporary footpath diversions

e. restoration of temporary construction areas, works to restore and make safe temporary work sites and work areas, including (as necessary) removal of hardstanding areas, temporary structures and other temporary works and works to re-establish original ground levels

f. works to trees

g. works to create temporary or permanent landscaping, including drainage and flood compensation, means of enclosure, and reinstatement / replacement of, or construction of, boundary walls and fences including gates

h. formation of construction vehicle accesses and provision of temporary gated or other site accesses and other works to streets

i. diversions (both temporary and permanent) of existing traffic and pedestrian access routes and subsequent reinstatement of existing routes, and works to create permissive rights of way

j. modifications of existing accesses, railings and pedestrian accesses

k. provision of construction traffic signage

l. relocation of existing bus stops and provision of temporary bus lay-bys

m. construction of new permanent moorings and piers, including access brows, bank seats, gangways and means of access

n. permanent and temporary works for the benefit or protection of land or structures affected by the authorised project (including protective works to buildings and other structures, and works for the monitoring of buildings and structures)

o. temporary landing places, moorings or other means of accommodating vessels in the construction and/or maintenance of the authorised project

p. provision of buoys, beacons, fenders and other navigational warning or ship impact protection works

q. such other works as may be necessary or expedient for the purposes of or in connection with the construction of the authorised project which do not give rise to any materially new or materially different environmental effects from those assessed in the Environmental Statement

3.2.8 The works defined by bullet c, k, l, and m (in the list above) are not considered likely to be applicable to the works proposed at this site.

### Ancillary Works

3.2.9 These works are not “development” as defined in section 32 of the Planning Act 2008, they do however form part of the Thames Tideway Tunnel project for which development consent will be sought and are included within Schedule 1 of the *Draft DCO*.

3.2.10 The following ancillary works are set out in Schedule 1 to the *Draft DCO*:

a. works within the existing sewers, chambers and culverts and other structures that comprise the existing sewerage network for the purposes of enabling the authorised project, including reconfiguring, modifying, altering, repairing, strengthening or reinstating the existing network

b. works within existing pumping stations including structural alterations to the interior fabric of the pumping station(s), works to reconfigure existing pipework, provision of new pipework, new penstock valves and associated equipment, modification of existing electrical, mechanical and control equipment, and installation or provision of new electrical, mechanical and control equipment

c. installation of electrical, mechanical and control equipment in other buildings and kiosks and modification to existing electrical, mechanical and control equipment in such buildings and kiosks

d. installation of pumps in chambers and buildings

e. works to trees and landscaping works not comprising development

f. works associated with monitoring of buildings and structures

g. provision of construction traffic signage

h. the relocation of boats/vessels

## Design principles

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

3.2.12 The generic principles include principles for the integration of functional components and also principles for heritage, landscape, lighting and site drainage.

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

3.2.14 The *Design Principles* report is provided in Vol 1 Appendix B.

## Site features and landscaping

3.2.15 The above-ground structures are shown at indicative scale on the Proposed landscape and the scale of these structures (in addition to the defined heights) has been considered within the assessments as appropriate. All other features on the plan, other than those which are otherwise captured in the design principles are illustrative only and have not been assessed. The possible locations of these above-ground structures, as well as the CSO drop shaft, are defined by the zones on the Site works parameter plan (see separate volume of figures – Section 1).

3.2.16 All other features on the Proposed landscape plan are illustrative only and have not been assessed. There are no other landscaping proposals, other than those captured by the design principles, either for approval or indicative, for this site.

### Code of Construction Practice

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

3.2.18 The *CoCP* forms an integral part of the project and all of the measures contained therein are assumed to be in place during the construction process described in Section 3.3 below. The measures are not described within the Section 3.3 although further details on the measures within the *CoCP* Part B Earl Pumping Station are given within the relevant assessments.

## 3.3 Construction assumptions

3.3.1 This section describes the approach to construction which has been assumed for the purposes of the EIA. The construction programme, layouts and working methods are illustrative and do not form part of the project for which consent is sought.

3.3.2 Although the programme, layouts and working methods described are illustrative, they represent what is considered to be the likely approach, given the existing site constraints, the adjacent land uses and the construction requirements. This section describes the main activities with the focus on those that are relevant for the assessment of environmental effects.

3.3.3 The assumed construction programme is described first, followed by a description of typical construction activities.

3.3.4 It is also assumed that, where the appropriate powers do not form part of the Development Consent Order, further consents may be required before certain construction activities are progressed. These could include various consents issued by the EA (including Flood Defence Consents, Abstraction Licenses and Discharge Consents) and others as appropriate.

### Assumed construction programme and working hours

3.3.5 Construction at this site would be likely to commence in 2017 (Site Year 1) and would be completed by 2021 (Site Year 5). The site would be operational in 2023 when the Thames Tideway Tunnel project as a whole becomes operational.

3.3.6 Construction at Earl Pumping Station is anticipated to take approximately four years and would involve the following main works (with some overlaps):

a. Site Year 1 – Site setup (approximately six months)

b. Site Years 1 to 2 – CSO drop shaft construction (approximately 15 months)

c. Site Years 2 to 3 – Construction of other structures (approximately 14 months)

d. Site Years 3 to 4 – Completion of works and site restoration (approximately 14 months).

3.3.7 This site would operate to the standard and extended working hours for various phases and activities as set out in the *CoCP* Part A and B (Section 4). Standard working hours would be applied to all of the above phases of construction work apart from elements of drop shaft construction and secondary lining as described below.

3.3.8 It has been assumed that extended working hours would be required for this site approximately twice a week during diaphragm walling for a total duration of approximately three months, and for once a month during other major concrete pours. Extended working hours would be required at this site to allow for major concrete pours for drop shaft construction including diaphragm wall panels, base slab, roof slab and other large elements. During these periods only those activities directly connected with the task would be permitted within the varied hours.

3.3.9 The exact timing of any extended hours of working would be consulted on, and notified to the London Borough of Lewisham.

### Typical construction activities

3.3.10 Vol 22 Table 3.3.1 identifies the construction phasing plans used for the assessment of construction effects. These plans have been prepared to illustrate possible site layouts for the principal construction phases and relevant activities:

**Vol 22 Table 3.3.1 Earl Pumping Station – construction phase plans**

| Plan title | Activities | Status | Location |
|---|---|---|---|
| Construction phases – phase 1 | Site setup<br>CSO drop shaft construction | Illustrative | Vol 22 Earl Pumping Station figures – Section 1 |
| Construction phases – phase 2 | Construction of other structures | Illustrative | Vol 22 Earl Pumping Station figures – Section 1 |

3.3.11 The methods, order and timing of the construction work outlined herewith are illustrative, but representative of a practical method to construct the works and suitable upon which to base the assessment.

3.3.12 The following construction related activities are described:

a. site setup
b. shaft construction
c. tunnel works
d. shaft secondary lining
e. construction of other structures
f. completion of works and site restoration.
g. excavated materials and waste
h. access and movement

### Site setup

3.3.13 Trees to the west of the existing pumping station adjacent to Croft Street may require maintenance and pruning in advance of the works.

3.3.14 Part of the proposed site is currently occupied by businesses which would need to be relocated.

3.3.15 Prior to any works commencing the site boundary would be established and would consist of close boarded hoarding panels to the heights specified in the *CoCP* Part B Earl Pumping Station (Section 4). Welfare and office facilities would also be set up in this phase.

3.3.16 Other site works set up at this early stage would include the setting up of the required site accesses from Croft Street and Yeoman Street and introduction of the required traffic management activities.

3.3.17 Utility and power connections would be required to service the construction and would be set up in this phase.

3.3.18 The extent of demolition and site clearance works are shown on the Demolition and site clearance plan (see separate volume of figures – Section 1). It is assumed that demolition would take approximately one month. The approach to any land remediation that might be required cannot be defined at this stage. However it is assumed that any remediation that is required and which is likely at this site would occur within this earliest phase of construction and that any associated lorry movements are substantially lower than the subsequent peak during the main construction phases.

### Shaft construction

3.3.19 Once the site has been prepared as described above, plant and material storage areas (including displaced slurry storage), plant and material storage areas for drop shaft and tunnel connection works and the delivery vehicle turning area would be set up on site. Major plant required for the CSO drop shaft construction would include cranes, a clamshell grab, diaphragm wall rigs, bentonite silos, separation plant, water tanks, mixing pans, compressors, air receivers, excavators and dumpers.

3.3.20 The presence of the creosote contamination within the sands and gravels at this site is likely to require specific measures to be adopted by the contractor to ensure that a pathway is not created into the underlying chalk aquifer during shaft construction. Measures to be adopted may include, as a minimum, procedures to ensure a positive bentonite slurry pressure is maintained at all times within the trench so that contaminated material cannot flow into the excavation. If these measures are deemed unsatisfactory the diaphragm walls may need to be constructed through an oversize slurry panel. The details would be developed by specialist contractors.

3.3.21 The CSO drop shaft would be constructed by diaphragm wall construction techniques. The first stage in the construction of each panel of diaphragm wall would be the excavation and forming of inner and outer guide walls. These guide walls would provide secure supports between which excavation for the diaphragm walls would be undertaken. During diaphragm wall excavation the trench would be filled with bentonite for ground support; on completion of excavation cycle, steel bar reinforcement cages would be lowered in before concrete is pumped into the trench in order to displace the bentonite and form a wall panel. .

3.3.22 This process would be repeated for each diaphragm wall panel in order to create the full circle of the drop shaft. Diaphragm wall excavated material would be processed as required and then loaded onto a lorry for transport off site.

3.3.23 The size of the diaphragm wall panels would require an extended working day to enable the concrete pour to be completed.

3.3.24 The diaphragm wall would be taken to a depth suitable to reduce the flow of water into the drop shaft. Grouting at the toe of the diaphragm wall and base would also be required to reduce the inflow of water. Dewatering would need to be undertaken as described below.

3.3.25 The CSO drop shaft excavation would commence after the diaphragm walls are complete. The guide walls would be broken out, and the soil within the diaphragm walls excavated to expose the walls. The excavator within the drop shaft would load shaft skips, hoisted by crawler crane, depositing the excavated material within the handling area. Excavated material would be put into skips within the drop shaft working area and hoisted by crawler crane from the drop shaft and deposited in a suitable storage area. After any required treatment, the material would be loaded onto a lorry for transport off site. Once the excavation is complete, a steel reinforced concrete base plug would be formed at the base of the drop shaft.

3.3.26 It is anticipated that dewatering would be required at this site. Dewatering wells would be drilled from the surface within the drop shaft (a process known as ‘internal dewatering’) and groundwater extracted via pumps. These pumps would be operational during drop shaft excavation. The extracted ground water would be treated as required (at this site some contamination is expected) and then, dependant on final water quality, either discharged via the existing storm relief sewer upstream of the pumping station (and so into the tidal reaches of the River Thames [tidal Thames]) or to the local sewer network in Croft Street. Extracted water would be sampled on a regular basis to check water quality.

3.3.27 It is anticipated that ground treatment would also be required during the interception and CSO works.

### Tunnel works

3.3.28 As the Earl Pumping Station CSO drop shaft would be online with the Greenwich connection tunnel, there is no short connection tunnel to be constructed. A temporary cradle would be constructed to receive the tunnel boring machine (TBM) from Deptford Church Street and re-launch to Chambers Wharf.

3.3.29 Grouting would additionally be required either side of the drop shaft to facilitate TBM break in / break out. This would consist of a block of treated ground, external to the drop shaft and would be constructed using fissure grouting techniques from within the excavated drop shaft.

3.3.30 Tunnel portals with the launch and reception seals would be formed in the drop shaft lining. The portals would consist of cast in-situ concrete with a sealing arrangement tied to the drop shaft lining.

### Secondary lining of shaft

3.3.31 It is assumed that the lining of the CSO drop shaft would be made of reinforced concrete placed inside the drop shaft's primary support. The steel reinforcement would be assembled in sections and a shutter would be used to cast the concrete against. The shutter would be assembled at the bottom of the drop shaft and sections of reinforcement installed and lining cast progressively up the drop shaft. At this site, because the drop shaft extends above finished ground level, an external shutter would be added to allow construction of the drop shaft to continue above ground level to the proposed roof slab level.

3.3.32 Any reinforced concrete structures internal to the drop shaft and the roof slab would be constructed in a similar manner progressively from the drop shaft bottom. In some cases precast concrete members may be used.

3.3.33 At this site it is assumed that concrete would be supplied by ready mix concrete mixer trucks.

### Construction of other structures

3.3.34 An interception chamber, connection culvert and valve chamber would be constructed to intercept the sewer running into the existing pumping station and connect it to the drop shaft. In addition, air management structures comprising an underground chamber, a ventilation column and louvre chambers for ventilation control would be constructed

3.3.35 Sheet pile and /or secant pile walls would be used to provide support within which the underground chambers to be constructed. Piled walls would stop short of the existing sewer. Generally the walls would be driven to depth to minimise water ingress into the excavation under the wall. During piling works, techniques such as utilising positive slurry pressures, would need to be instigated to ensure that the known contamination is not spread to underlying strata.

3.3.36 Due to the presence of the creosote contamination, it is assumed that the base of the excavation would be treated by jet grouting (or similar) techniques.

3.3.37 The chamber would be excavated exposing the sewer. The sewer would be internally lined and supported during excavation.

3.3.38 Small pumps would be utilised to manage any ground water that does seep through and treated in accordance with the approach described above.

3.3.39 The walls, bases and roofs of the chambers and shallow foundations for above-ground structures would be formed by in-situ concrete techniques. Ready mixed concrete (or onsite batched concrete if available) would be pumped or skipped to the chamber. The piled walls would be extended to the drop shaft to allow the connecting culvert to be constructed in a similar manner to the chambers.

3.3.40 It is assumed that piles would be to support the underground chambers, and would be bored reinforced concrete piles. The diameter, depth and spacing would depend on the structure design and ground conditions.

3.3.41 For the above-ground structures, including the kiosk and ventilation column (but excluding the above ground shaft structure), the components would be delivered by road and assembled on site using suitable lifting equipment.

### Completion of works and site restoration

3.3.42 On completion of the construction works the permanent works area would be finished in accordance with the landscaping requirements (see Section 3.2).

### Excavated materials and waste

3.3.43 The construction activities described above and in particular the construction of the drop shaft would generate a large volume of excavated material which would require removal. This is estimated at 50,000 tonnes, the main elements of which would comprise approximately 11,000 tonnes of mixed materials from the diaphragm wall construction, 7,000 tonnes of made ground, 2,000 tonnes of Lambeth group, 2,000 tonnes of Thanet sands and 23,000 tonnes of chalk.

3.3.44 In addition, it is estimated that approximately 900 tonnes of construction waste would be generated including 100 tonnes of imported fill and 600 tonnes of concrete.

3.3.45 Excavated materials and construction wastes would be exported from the site in accordance with the *Transport strategy* which accompanies the application for development consent (the ‘application’) (see Access and movement below).

### Access and movement

3.3.46 For the purposes of the assessment a single trip to or from the site is referred to as a 'movement', while two trips, one to and one from the site, are referred to as a 'lorry'.

3.3.47 Peak vehicle movements would be associated with specific site activities. The highest lorry movements at the site would occur during drop shaft construction when material would be removed from the site by road. The daily vehicle movements at this time, averaged over a one month period, would be 34 HGV lorries, equivalent to 68 movements per day. It is estimated that total vehicle numbers for this site would be in the order of 9,100 HGV lorries, equivalent to 18,200 movements over the construction period.

3.3.48 The site has two proposed separate access points with one from Yeoman St and the other onto Croft Street. The proposed entry point would be via a right turn into the site from Yeoman St and the egress would be a right turn from the site onto Croft Street.

3.3.49 Lorries would access via Plough Way turning right into Yeoman Street. Construction traffic would egress along Chilton Grove to turn left onto Lower Road (A200) and most likely proceed southbound along the A200 towards the A2.

3.3.50 To depart to the north, construction traffic would take the left turn and then use the A200 gyratory of Bestwood St and Bush Road before continuing northbound along the A200.

3.3.51 A *Traffic management plan* would be developed for the site, produced, coordinated and implemented by the contractor.

3.3.52 A *Draft Project Framework Travel Plan* which accompanies the application has been produced setting out the requirements and guidelines for the site-specific *Travel plans* to be developed by the contractor.

## 3.4 Operational assumptions

3.4.1 This section provides details of the assumptions which have been made for the operational phase for the purposes of the EIA. Unless otherwise also listed in Section 3.2, the details given are illustrative and do not form part of the project for which consent is sought.

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

3.4.3 The operational structures are described first, followed by the assumed maintenance regime.

3.4.4 Once developed the project would divert the majority of the current Earl Pumping Station CSO discharges via the CSO drop shaft and Greenwich connection tunnel to the main tunnel for treatment at Beckton Sewage

Treatment Works. The number of discharges from the CSO would be reduced by 22 spill events to approximately four spill events per typical year at an average rate of 51,000$m^3$ per year.

## Operational structures

3.4.5 For the purposes of the application, each of the main operational structures is shown as being located within a defined zone, in which the structure would be located. The operational structures listed within the proposed schedule of works in Section 3.2 along with the relevant plans, form part of the proposed development for consent. The defined zones for the structures are shown on the Site works parameter plan (see separate volume of figures – Section 1).

3.4.6 The heights of the main ventilation columns and structures, chambers, drop shaft parapet, also form part of the project for consent (see Section 3.2). The following text provides additional clarification on the assumed form, purpose, function and working of these and other structures where this is considered helpful to the reader.

3.4.7 Other than the land retained for public realm adjacent to Croft Street, the land which is not required for operational purposes would, in due course, be released for development following completion of construction.

3.4.8 The assessment for each of the environmental topics has been based on the most appropriate dimensions and siting of the structures to ensure the assessment is robust. For example, the lower height for the ventilation column would typically generate higher odour impacts than a higher height and so the lower height limit has been modelled in the assessment. For other topics such as townscape, the upper height may be more important and has been assessed. The approach that has been adopted in this regard is explained within each topic assessment section, where necessary.

3.4.9 The approximate dimensions provided for underground structures are internal dimensions which are determined by the hydraulic and access requirements at particular sites.

3.4.10 Once constructed and operational the structures listed in the following sections would remain on site. At this site, electrical equipment would be housed within the existing pumping station building and there is no requirement for a new electrical and control kiosk.

### Shaft

3.4.11 The Earl Pumping Station site CSO drop shaft would be constructed on the line of the long connection tunnel that would run from Greenwich to Chambers Wharf (Greenwich connection tunnel). The location, diameter and depth of the drop shaft including its vertical projection above ground level are described in Section 3.2.

3.4.12 There would be covers on top of the drop shaft to allow access and inspection. There would be pressure release and air inlet structures on top of the drop shaft.

### Chambers and culverts

3.4.13 The interception chamber and culvert would be below ground. Part of the valve chamber would extend above ground within the above-ground structures defined in Section 3.2. There would be covers on top of the chambers to allow access and inspection.

### Air management structures

3.4.14 The heights and locations of above-ground air management structures, which comprise the ventilation columns are defined in Section 3.2. The filter would be housed in a below ground chamber within the Thames Water pumping station compound. Other air pressure relief and air inlet structures would be positioned on the roof of the raised drop shaft structure.

3.4.15 The small diameter vent stacks next to the wall of the existing pumping station building would allow ventilation of the interception chamber.

3.4.16 Below-ground structures would contain passive filters and connect the ventilation columns to the structures that they are ventilating. These would have ground level covers to allow access and inspection.

### Permanent restoration and landscaping

3.4.17 The Proposed landscape plan is presented in a separate volume of figures (Section 1). The final design on the landscape and restoration proposals would be subject to both the generic and site-specific design principles (see Section 3.2).

3.4.18 The existing pumping station compound wall would be reinstated in its current position.

3.4.19 Much of the operational structure at the site would be below ground. However the drop shaft and valve chamber need to be finished to approximately 3m above ground level due to hydraulic requirements. These structures would be brick clad and the drop shaft and the valve chamber would have a brown roof.

3.4.20 The area around the drop shaft would be finished with hardstanding to allow crane access to the covers on top of the drop shaft. Much of this hardstanding would be publicly accessible but a right of access over it would be retained and temporary security fencing provided when the area is used for drop shaft access.

3.4.21 The area within the pumping station would be returned to hardstanding to provide continued operational access within the pumping station. New gates would be added to the existing pumping station boundary.

3.4.22 Access to the Earl Pumping Station site would continue to be through gates on Chilton Grove and Yeoman Street. In addition a new vehicular access gate would be installed between the existing Thames Water site and the additional land to the south to allow access to the hardstanding around the drop shaft. Vehicular access to the site would be possible both through this gate and from Croft Street.

3.4.23 The southern part of the land, which falls outside of the Earl Pumping Station site, adjacent to Croft Street, would be accessible to the public by foot. Vehicular access to the area would be restricted.

3.4.24 Street lighting would be reinstated. Lighting would be provided to the staircase and drop shaft surface for use during maintenance activity only.

### Typical maintenance regime

3.4.25 A light commercial vehicle would undertake three to six monthly maintenance works. This would be carried out during normal working hours and would take approximately half a day. Additionally, once every ten years, more substantial maintenance work would be carried out. This would also be carried out in normal working hours. Vehicular requirements for these visits would include two mobile cranes and associated support vehicles and equipment.

## 3.5 Base case and cumulative development

3.5.1 The assessments undertaken for this site take account of other relevant development projects within the vicinity of the site which are under construction, permitted but not yet implemented or submitted but not yet determined. In order to identify the relevant developments for consideration, the Planning Inspectorate, local planning authorities, Greater London Authority and Transport for London have been consulted on the methodology (see Volume 2) and asked to assist in identifying and verifying the development schedules included in the assessment. A schedule is provided in Vol 22 Appendix N of the resulting development projects, a description of what is proposed and assumptions on phasing. Longer term development projects may be included under both base case, with construction preceding that of the Thames Tideway Tunnel site, and cumulative with construction or operation occurring at the same time as a given Thames Tideway Tunnel site.

3.5.2 The development projects which have been included under base case, cumulative or both for the assessment of the proposed development at Earl Pumping Station site are listed below. A map showing their location is included in Vol 22 Figure 3. 5.1 (see separate volume of figures):

a. Cannon Wharf, 35 Evelyn Street

b. Yeoman Street

c. Marine Wharf West, Plough Way

d. Tavern Quay, Rope Street

e. Oxestalls Road

f. Surrey Quays Leisure Site

g. Quebec Way Industrial Estate

h. Convoys Wharf

i. Canada Water, Surrey Quays Road, Site C

j. Canada Water, Surrey Quays Road, Site A

k. Mulberry Business Park

l. Surrey Canal Triangle

## 3.6 On-site alternatives

3.6.1 Project-wide and site selection alternatives are addressed in Vol 1Section 3. This section describes on-site alternatives that have been considered and provides the main reasons why these alternatives (to the proposed approach) have not been adopted.

3.6.2 Vol 22 Table 3.6.1 below identifies those items for which alternatives have been considered, the alternatives and provides the main reasons why the alternatives were not taken forward.

**Vol 22 Table 3.6.1 Earl Pumping Station − on-site alternatives**

| Item | Alternatives considered | Reasons not progressed |
|---|---|---|
| Land use of land not required during operational phase | A new are of green space (a 'pocket park') on land east of the operational structures | • LB Lewisham believes the location would not be suitable for a small green space of this type and it would be preferable to leave it for future development. |
| CSO drop shaft location | A location slightly further east (distance) | • A desire to maximise the area to the east of the drop shaft available for subsequent development. |
| Size and shape of above-ground structures | A larger rectangular design with separate ventilation columns | • A desire to minimise the footprint and so maximise the area available for development.<br>• A more rounded profile was considered preferable by CABE and others.<br>• Integrating the ventilation structure with the main structure was considered preferable by CABE. |

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Thames Tideway Tunnel
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 4: Air quality and odour

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

Hard copy available in

Box **36** Folder **A**
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 4: Air quality and odour

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# 4 Air quality and odour

## 4.1 Introduction

4.1.1 This section presents the findings of the assessment of the likely significant air quality and odour effects of the proposed development at the Earl Pumping Station site. The project-wide air quality effects are described in Volume 3 Project-wide effects assessment.

4.1.2 The proposed development has the potential to affect air quality and odour due to:

a. construction traffic on the roads leading to an increase in vehicle emissions (air quality)

b. temporary closure of lanes during construction, which can lead to an increase in vehicle emissions through worsened congestion (air quality)

c. emissions from construction plant (air quality)

d. construction-generated dust (air quality)

e. emissions from removal of contaminated material during construction (odour and air quality)

f. operation of the tunnel, resulting in air emissions (odour).

4.1.3 Each of these impacts is considered within the assessment. As a result the construction assessment for Earl Pumping Station site comprises four separate components: effects on local air quality from construction road traffic; effects on local air quality from construction plant; effects from construction dust and odour / air quality effects from removal of contaminated material. The effects on local air quality from construction road traffic and construction plant are assessed together (within the same model) while construction dust is assessed separately. The operational assessment considers the potential for nuisance odour emissions from the operation of the tunnel. As set out in the *Scoping Report*, local air quality effects are not assessed during operation on the basis that the only relevant operational source of air pollutants would be from the infrequent visits of maintenance vehicles which would not result in a likely significant effect.

4.1.4 The assessment of air quality and odour presented in this section has considered the requirements of the National Policy Statement for Waste Water Sections 4.3 (odour), 4.11 (air quality and emissions) and 4.12 (dust). Further details of these requirements can be found in Vol 2 Section 4.3.

4.1.5 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (see Volume 22 Earl Pumping Station figures). Appendices supporting this site assessment are contained in Vol 22 Appendix B.

## 4.2 Proposed development relevant to air quality and odour

4.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to air quality and odour are set out below.

### Construction

#### Construction road traffic

4.2.2 During the proposed construction period there would be construction traffic movements[i] in and out of the site.

4.2.3 The highest number of lorry movements in any one year at the Earl Pumping Station site would occur during the shaft construction (Site Year 1 of construction). The average daily number of vehicle movements during the peak month would be approximately 68 movements per day.

4.2.4 The construction traffic routes, traffic management and access to the site are detailed in Section 12 of this volume.

4.2.5 Construction traffic is likely to affect local air quality as a result of increasing traffic and therefore emissions on the road network.

#### Construction plant

4.2.6 Construction plant is likely to affect local air quality from direct exhaust emissions associated with the use and movement of the plant around the site.

4.2.7 There are a number of items of plant to be used on site that may produce emissions that could affect local air quality. Examples of such plant are excavators, generators and dumper trucks.

4.2.8 Typical construction plant which would be used at the Earl Pumping Station site in the peak construction year and associated emissions data are presented in Vol 22 Appendix B.3.

#### Construction dust

4.2.9 Activities with the potential to give rise to dust emissions from the proposed development during construction are as follows:

a. site preparation and establishment

b. demolition of existing infrastructure and buildings

c. materials handling and earthworks

d. construction traffic – from moving over unpaved ground and then tracking out mud and dirt onto the public highway (termed ‘trackout’ hereafter).

4.2.10 At the Earl Pumping Station site there would be approximately 1,640m$^3$ of demolition material generated while the amount of material moved during

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[i] A movement is a construction vehicle moving either to or from the site.

the earthworks would be approximately 50,000 tonnes. The volume of building material used during construction would be approximately 12,800m$^3$.

### Construction related volatile contaminant emissions

4.2.11 The soil on the Earl Pumping Station site is contaminated with polycyclic aromatic hydrocarbons, petroleum hydrocarbons and to a lesser extent with BTEX (benzene, toluene, ethyl-benzene and xylene). The hydrocarbon component considered to be of most concern is naphthalene. Naphthalene is odorous and has a World Health Organisation guideline set to protect human health as it is a suspected carcinogen. Polycyclic aromatic hydrocarbons (PAHs) are volatile and can be released during excavation and soil movement.

4.2.12 Activities with the potential to give rise to naphthalene emissions from the proposed development during construction are as follows:

a. site preparation and establishment

b. materials handling and earthworks.

4.2.13 The potential for these processes to impact sensitive receptors is dependent on many factors including the following:

a. location of the construction site

b. proximity of sensitive receptors

c. extent of any intended excavation

d. nature, location and size of stockpiles containing contaminated material and length of time they are on site

e. weather conditions.

### Code of construction practice

4.2.14 Appropriate dust and emission control measures are included in the *Code of Construction Practice (CoCP)*[ii] *Part A* (Section 7) in accordance with the London Councils Best Practice Guidance (GLA and London Councils, 2006)[1]. Measures incorporated into the *CoCP* Part A (Section 7) to reduce air quality impacts include measures in relation to vehicle and plant emissions, measures to reduce dust formation and re-suspension, measures to control dust present and measures to reduce particulate emissions. These would be observed across all construction and demolition activities at the Earl Pumping Station site.

4.2.15 The effective implementation of the *CoCP* Part A (Section 7) measures is assumed within the assessment.

## Operation

4.2.16 A ventilation structure would treat air from the tunnel. The air would be treated by passing through a carbon filter housed within a ventilation

[ii] The Code of Construction Practice (CoCP) is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

structure adjacent to the shaft. The capacity of the passive filter would be $1m^3/s$. The maximum air release rate during a typical year is expected to be less than $0.7m^3/s$, therefore all air in a typical year would be treated through the passive filter. No nuisance odours are therefore expected.

4.2.17 Air would be released from the ventilation structure for about 30 hours in a typical year, all of which would have passed through the passive filter. For the remaining hours, no air would be released; although, air intake would occur as the tunnel is emptied.

### Environmental design measures

4.2.18 A carbon filter would be included as part of the ventilation structure design and construction. The passive filter would remove odours by adsorption onto the filter.

## 4.3 Assessment methodology

### Scoping

4.3.1 Ground investigation works revealed that the soil on the site is contaminated with polycyclic aromatic hydrocarbons, petroleum hydrocarbons and BTEX. Although an assessment of the effect on air quality and odour of moving this material was scoped out at the scoping stage, given the nature and quantity of contamination found during ground investigation works, this assessment has been scoped back in for the Earl Pumping Station site.

### Engagement

4.3.2 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the ES. Specific comments relevant to this site for the assessment of air quality and odour are presented here (Vol 22 Table 4.3.1).

**Vol 22 Table 4.3.1 Air quality and odour – stakeholder engagement**

| Organisation | Comment | Response |
|---|---|---|
| LB of Lewisham, Position Paper, January 2011 | Idling of construction vehicle and plant must not be allowed at sites in LB of Lewisham. | Idling will be controlled through the *CoCP*. |
| LB of Lewisham, April 2011 | Agree monitoring locations with LB of Lewisham | Locations agreed with LB of Lewisham Senior Air Quality Officer. |
| LB of Lewisham, July 2012 | Odour complaints in the area should be considered | One odour complaint made to LB of Lewisham near Earl Pumping Station in recent years; confirmed by LB of Lewisham Environmental Protection Officer. |
| LB of Lewisham, | The site is located within an air | The area has been |

| Organisation | Comment | Response |
|---|---|---|
| Phase two consultation, February 2012 | quality management area and therefore Thames Water will be expected to demonstrate that proposals do not result in a reduction in air quality, as set out in Core Strategy Policy 9 and the Lewisham Air Quality Action Plan (2008). The air quality impacts arising from traffic and construction/excavation activities are concerning and further information is required about the impacts and how these will be managed and mitigated. | assessed for construction / excavation activities and for construction traffic. The results are summarised in Section 4.5. Modelling and monitoring data are also included in this assessment. Measures which are embedded in the project are detailed in the *CoCP* Part A. |
| LB of Lewisham Section 48 response, October 2012 | The site is located within an air quality management area and therefore Thames Water will be expected to demonstrate that proposals do not result in a reduction in air quality, as set out in Core Strategy Policy 9 and the Lewisham Air Quality Action Plan (2008). The air quality impacts arising from traffic and construction/excavation activities are concerning and further information is required about the impacts and how these will be managed and mitigated. | The area has been assessed for construction/excavation activities and for construction traffic. The results are summarised in Section 4.5. Modelling and monitoring data are included in the assessment. Measures which are embedded in the project are set out in the *CoCP* Part A. |
| LB of Southwark, Phase two consultation, February 2012 | Chambers Wharf, Shad Thames Pumping Station and Earl Pumping Station are all located within an Air Quality Management Area. Thames Water will be expected to demonstrate that proposals do not result in a reduction in air quality, through an air quality assessment, as set out in Southwark plan policy 3.8 | It has been noted in the baseline assessment that the site is in an AQMA. An air quality assessment has been undertaken to determine whether there are any significant effects on local air quality. |

## Baseline

4.3.3 The baseline methodology follows the methodology described in Vol 2 Section 4. There are no site specific variations for identifying baseline conditions for this site.

## Construction

4.3.4 The assessment methodology for the construction phase follows that described in Vol 2 Section 4. Due to the contaminated land at the site, an assessment has also been made of naphthalene which would volatilise[iii] during ground works. Naphthalene has been assessed in terms of odour and toxicity in air. Naphthalene emissions have been estimated by the ground contamination specialists based on the quantities of materials moved, naphthalene content in soil and the volatility of naphthalene. The maximum naphthalene content found on the site has been used for the odour modelling as peak concentrations are of most interest. A slightly lower content, across the site ($95^{th}$ percentile), has been used for the air quality modelling as the health criterion is for an annual average. Variable emission rates were used for the odour modelling with highest emissions during the day on a weekday and lowest emissions at the weekends. A weekly average emission rate was used for the health modelling. Dispersion modelling has been carried out in the same way as for the construction plant impacts.

4.3.5 Section 4.5 details the likely significant effects arising from the construction at the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could elevate construction dust nuisance effects within the assessment area (see para. 4.3.6 below). With regard to local air quality, the effect of all relevant traffic associated with Thames Tideway Tunnel project sites using the highway network in the vicinity of the site is taken into account in the assessment as traffic data used for the assessment includes traffic associated with all Thames Tideway Tunnel project sites.

### Construction assessment area

4.3.6 The assessment area for the local air quality assessment during construction covers a square area of 600m by 600m centred on the Earl Pumping Station site. This assessment area has been used for the assessment of road transport, construction plant and construction dust and has been selected on the basis of professional judgement to ensure that the effects of the Earl Pumping Station site are fully assessed. A distance of 200m is generally considered sufficient (Highways Agency, 2007)[2] to ensure that any significant effects are considered.

4.3.7 The assessment area selected for the construction related volatile contaminant emissions study is 300m by 300m as the largest impacts would be adjacent to the site boundary.

### Construction assessment years

4.3.8 The peak construction year, in terms of construction traffic movements (Site Year 1 of construction), has been used as the year of assessment for construction effects (construction road transport, construction plant and construction dust) in which the development case (with Thames Tideway Tunnel project) has been assessed against the base case (without

[iii] volatilise: evaporate rapidly

Thames Tideway Tunnel project) to identify likely significant effects of the Thames Tideway Tunnel project.

4.3.9 The assessment of construction effects also considers the extent to which the effects on local air quality would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

4.3.10 Site Year 2 of construction has been used for the naphthalene assessment as it is during this year that the greatest movements of contaminated soil would take place.

### Other developments

4.3.11 As indicated in the site development schedule (see Vol 22 Appendix N), there are four other new developments (Yeoman Street, Marine Wharf West, Cannon Wharf and Tavern Quay) identified within a 300m radius (construction assessment area) of the Earl Pumping Station site. Two of these (Cannon Wharf and Tavern Quay) are relevant to the air quality assessment being sensitive properties in close proximity to the site that would be fully or partially complete and operational in Site Year 1 of construction. These developments are therefore considered as receptors in the air quality assessment. The developments at Yeoman Street and Marine Wharf West are not considered as receptors as they would still be under construction in Site Year 1 of construction. Trips associated with the other developments are taken into account in the traffic data used for the air quality assessment.

4.3.12 Three of the developments, Yeoman Street, Cannon Wharf and Marine Wharf West, would have buildings under construction during Site Year 1 of construction. There is therefore the potential for cumulative effects which are considered in Section 4.7.

## Operation

4.3.13 The odour assessment methodology for the operational phase follows that described in Vol 2 Section 4. There are no site specific variations for undertaking the operational assessment of this site.

4.3.14 Section 4.6 details the likely significant effects arising from the operation at the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on odour within the assessment area for this site, and therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

### Operational assessment area

4.3.15 Odour dispersion modelling has been carried out over an area of 500m by 450m centred on the Earl Pumping Station site. The assessment area has been selected on professional judgement on the basis of it being considered the potential maximum extent of the impact area.

### Other developments

4.3.16 Regarding other new developments, the four developments identified above (Yeoman Street, Marine Wharf West, Cannon Wharf and Tavern Quay) are relevant to the odour assessment representing additional receptors requiring consideration. Due to the nature of the developments there are no cumulative operational effects to assess.

### Operational assessment year

4.3.17 The assessment undertaken for a typical use year (as described in Vol 2 Section 4) applies equally to all operational years. Therefore no specific year of operation has been assessed.

## Assumptions and limitations

### Assumptions

4.3.18 The general assumptions associated with this assessment are presented in Vol 2 Section 4.

#### Construction

4.3.19 The site specific assumptions in terms of model inputs for the local air quality dispersion modelling are set out in Vol 22 Appendix B.1.

4.3.20 The naphthalene emission rates used in the modelling for air quality and odour are shown in Vol 22 Appendix B.4. The odour emission rate assumes that the highest naphthalene concentrations found on site are present at that concentration in all soils handled. The naphthalene emission rates for the air quality modelling assume concentrations in soils being handled at the 95$^{th}$ percentile of measured concentrations. The organic component in soils was assumed to be low to make a greater proportion of the naphthalene in soils available for volatilisation.

#### Operation

4.3.21 The site specific assumptions in terms of the assumed capacity of the carbon filter and air release rate used for the odour dispersion modelling are described in paras. 4.2.16 - 4.2.18.

4.3.22 Odour dispersion modelling only includes emissions from the ventilation structure and does not take account of background concentrations due to other sources. Background odour concentrations in the area have been raised on occasions as 18 complaints have been made to Thames Water over a five year period (2007 to 2011) (see para. 4.4.12). Seasonal spot measurements of hydrogen sulphide ($H_2S$) carried out in 2011/2012 indicate that concentrations were typical of urban areas (Michigan Environmental Science Board, 2000)[3].

4.3.23 Following dispersion modelling, the maximum concentration predicted at any location has been reported whether this is at a building where people could be exposed or on open land. As a reasonable worst case assumption, it has been assumed that this is a relevant receptor. This means that should the ventilation structure be moved within the identified parameter plan (see Site Parameter Plan), the impact would not be worse than that reported in Section 4.6.

### Limitations

4.3.24 The general limitations associated with this assessment are presented in Vol 2 Section 4.

### Construction

4.3.25 As there are no $PM_{10}$ monitoring sites located within the vicinity of the Earl Pumping Station site, it has not been possible to verify $PM_{10}$ modelling results. The adjustment factor derived for $NO_x$ (from a comparison of modelled and monitored $NO_x$ data) has therefore been applied to the $PM_{10}$ modelling results.

4.3.26 Similarly, the naphthalene modelling results could not be verified.

### Operation

4.3.27 There are no additional limitations specific to the odour assessment of this site.

# 4.4 Baseline conditions

4.4.1 The following section sets out the baseline conditions for air quality and odour within and around the site. Future baseline conditions (base case) are also described.

## Current baseline

### Local air quality

4.4.2 The current conditions with regard to local air quality are best established through long-term air quality monitoring.

4.4.3 As part of their duties under Part IV of the Environment Act 1995 (UK Government, 1995)[4], local authorities, especially in urban areas where air quality is a significant issue, undertake long-term air quality monitoring within their administrative areas.

4.4.4 There are five $NO_2$ diffusion tubes and one continuous $PM_{10}$ monitoring station which collect data pertinent to the Earl Pumping Station site and associated construction traffic routes which are operated by Royal Borough (RB) of Greenwich, London Borough (LB) of Southwark and London Borough (LB) of Lewisham. The location of these is shown in Vol 22 Figure 4.4.1 (see separate volume of figures). Monitoring data for these monitoring sites for the period 2007-2011 are contained in Vol 22 Table 4.4.1 ($NO_2$ concentrations) and in Vol 22 Table 4.4.2 ($PM_{10}$ concentrations), although the $PM_{10}$ monitoring only started in January 2010 at Mercury Way.

**Vol 22 Table 4.4.1 Air quality – measured $NO_2$ concentrations**

| Monitoring site | Site type | Annual mean (µg/m$^3$) | | | | |
|---|---|---|---|---|---|---|
| | | 2011 | 2010 | 2009 | 2008 | 2007 |
| **Diffusion tube monitoring site** | | | | | | |
| Creek Road / McMillan Street (GW43) | Roadside | **57** | **41** | **59** | **58** | **62** |
| Sanford Street (L1) | Roadside | 36* | NM | NM | NM | NM |

| Monitoring site | Site type | Annual mean (µg/m$^3$) | | | | |
|---|---|---|---|---|---|---|
| | | 2011 | 2010 | 2009 | 2008 | 2007 |
| Grove Street (L3) | Roadside | 34* | NM | NM | NM | NM |
| Plough Way (L4) | Roadside | 37* | NM | NM | NM | NM |
| Grinling Gibbons (SCH018) | Urban background | 31 | 35 | NM | NM | NM |

*Note: NM indicates not measured. Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m3 for the annual mean. Code in brackets represents monitoring site identifier used in Vol 22 Figures 4.4.1 (see separate volume of figures). * Monitoring started in 2011.*

4.4.5 The monitoring data at the Creek Road / McMillan Street site show that the annual mean $NO_2$ objective / limit value has been exceeded at this roadside site in each of the five years. The annual mean $NO_2$ objective / limit value has been achieved at the other three roadside sites at which monitoring was undertaken in 2011 and also at the urban background site at Grinling Gibbons (SCH018) in 2010 and 2011. Hourly concentrations are not recorded at diffusion tube sites; however, as monitored annual mean $NO_2$ concentrations in recent years have been below 60µg/m$^3$ this suggests that exceedances of the hourly mean $NO_2$ objective / limit value are unlikely according to LAQM.TG(09) (Defra, 2009)[5].

4.4.6 The $PM_{10}$ monitoring data at the Mercury Way (LW3) site show that the annual mean and daily $PM_{10}$ objectives / limit values have been met in 2011 and 2010, which are the only years of monitoring data available for this site.

**Vol 22 Table 4.4.2 Air quality – measured $PM_{10}$ concentrations**

| Monitoring site | Site type | Annual mean (µg/m³) | | | | | Number of exceedances of daily standard | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2010 | 2009 | 2008 | 2007 | 2011 | 2010 | 2009 | 2008 | 2007 |
| Mercury Way (LW3) | Industrial | 23 | 23* | NM | | | 24 | 4 (44)* | NM | | |

*Note: NM indicates not measured. * As annual data capture is only 72%, the 90th percentile for the purpose of assessing against the daily mean, has been presented as well as the number of exceedances (in brackets). Code in brackets represents monitoring site identifier used in Vol 22 Figures 4.4.1 (see separate volume of figures).*

4.4.7 As a result of previous exceedances of air quality objectives, LB of Lewisham has declared the whole Borough an AQMA for both $NO_2$ and $PM_{10}$. Similarly the LB of Southwark has also declared the whole Borough as AQMA for both $NO_2$ and $PM_{10}$.

4.4.8 In addition to the local authority monitoring, diffusion tube monitoring has been undertaken as part of the environmental impact assessment (EIA) to monitor $NO_2$ concentrations in the vicinity of the Earl Pumping Station site. This monitoring comprises seven diffusion tubes based at the locations identified in Vol 22 Table 4.4.3. The table shows a 2010 annual mean concentration (baseline year), which has been calculated from the measurements made between April 2011 and April 2012 at each of the sites. To calculate the 2010 annual mean $NO_2$ concentrations, the 2011/12 measurements are adjusted for bias using the co-located diffusion tubes and are then seasonally adjusted. Annual mean $NO_2$ concentrations, for the period covered by the diffusion tubes, and for the year 2010 have been collated from four nearby background continuous monitoring sites measuring $NO_2$ and with data capture rates greater than 90%. The average of the ratios between the period and annual means has been used to calculate the seasonal adjustment factor. To enable any bias to be corrected a triplicate site (comprising three diffusion tubes) was established at a continuous monitoring site in Putney (site PEFM4 – see Vol 7); for additional precision, a triplicate site was established at one of the monitoring sites (EPSM7); otherwise all the monitoring locations have single tubes.

**Vol 22 Table 4.4.3 Air quality – additional monitoring locations**

| Monitoring site | Grid reference | Site type | 2010 $NO_2$ annual mean ($\mu g/m^3$) |
|---|---|---|---|
| Lower Road / China Hall Mews (EPSM1) | 535520, 179069 | Kerbside | **90.5** |
| Lower Road / Redriff Road (EPSM2) | 535706, 178931 | Kerbside | **77.3** |
| Bush Road (EPSM3) | 535828, 178708 | Kerbside | **83.9** |
| Plough Way (EPSM4) | 535991, 178863 | Urban background | **65.4** |
| Lower Road / Chilton Grove (EPSM5) | 535912, 178707 | Roadside | **71.8** |
| Chilton Grove (EPSM6) | 536083, 178811 | Urban background | **53.0** |
| Hazelwood Close / Lower Road (EPSM7) | 536111, 178541 | Roadside | **55.8** |

*Note: Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m³ for the annual mean.*

4.4.9 All seven sites recorded concentrations above the $NO_2$ annual mean standard of 40µg/$m^3$. The concentrations recorded during the monitoring are similar to those recorded during local authority monitoring and are typical of the levels in London.

4.4.10 This monitoring has been used in conjunction with existing LB of Lewisham monitoring to define the baseline situation and also to provide input to model verification[iv].

4.4.11 In addition to monitoring data, an indication of baseline pollutant concentrations in the vicinity of the site has been obtained from the background data on the air quality section of the Defra website (Defra, 2012)[6]. Mapped background pollutant concentrations are available for each 1km by 1km grid square within every local authority's administrative area for the years 2008 to 2020. The background data relating to the Earl Pumping Station site are given in Vol 22 Table 4.4.4 for 2010 (baseline year).

**Vol 22 Table 4.4.4 Air quality – 2010 background pollutant concentrations**

| Pollutant* | 2010 |
|---|---|
| $NO_2$ (µg/$m^3$) | 37.8 |
| $PM_{10}$ (µg/$m^3$) | 21.3 |

** Average of annual means for 1km grid squares centred on 535500, 178500 and 536500, 178500. An average of two squares has been used as the site straddles two 1km grid squares.*

## Odour

4.4.12 LB of Lewisham has received one odour complaint for the local area over recent years which was in 2007 (LB Lewisham, 2012)[7]. The Thames Water complaints database was reviewed for an area within a 500m radius of the site over the last five years (2007 – 2011). Eighteen complaints were received.

4.4.13 Data gathering for the EIA included spot measurements of $H_2S$ made near the site, the results of which are summarised in Vol 22 Table 4.4.5 and the monitoring locations showin in Vol 22 Figure 4.4.2 (see separate volume of figures). The highest concentrations, up to 33.6µg/$m^3$, were measured on 28 February 2012. These levels are typical of urban areas[3] when a faint odour may be detectable on occasions (WHO, 2000)[8] [v].

[iv] Model verification refers to checks that are carried out on model performance at a local level. This involves the comparison of predicted (modelled) versus measured concentrations. Where there is a disparity between the predicted and the measured concentrations, the first step should always be to check the input data and model parameters in order to minimise the errors. If required, the second step would be to determine an appropriate adjustment factor that can be applied to the modelled traffic contribution.

[v] The $H_2S$ odour detection threshold is 7ug/$m^3$ which is the level at which 50% of the people on an odour panel who have been proven to have a good sense of smell can just detect the gas in laboratory controlled conditions.

**Vol 22 Table 4.4.5 Odour – measured $H_2S$ concentrations**

| Location | Grid reference | Date | Time | $H_2S$ concentration ($\mu g/m^3$) |
|---|---|---|---|---|
| Chilton Grove / Croft Street (EPSS1) | 536097, 178803 | 28/08/11 | 08:12:12 | 0.0 |
| | | 28/08/11 | 08:12:44 | 0.0 |
| | | 30/10/11 | 08:39:28 | 6.3 |
| | | 30/10/11 | 08:39:56 | 0.0 |
| | | 01/12/11 | 12:22:31 | 10.0 |
| | | 01/12/11 | 12:23:38 | 8.9 |
| | | 20/02/12 | 11:52:12 | 29.1 |
| | | 20/02/12 | 11:53:46 | 7.7 |
| | | 28/02/12 | 17:18:25 | 33.6 |
| | | 28/02/12 | 17:19:38 | 8.1 |
| | | 18/05/12 | 16:47:00 | 7.2 |
| | | 18/05/12 | 16:48:05 | 6.6 |
| Yeoman Street 1 (EPSS2) | 536166, 178842 | 28/08/11 | 08:17:11 | 0.0 |
| | | 28/08/11 | 08:17:41 | 0.0 |
| | | 30/10/11 | 08:42:35 | 0.0 |
| | | 30/10/11 | 08:43:03 | 0.0 |
| | | 01/12/11 | 12:28:45 | 9.6 |
| | | 01/12/11 | 12:29:37 | 11.1 |
| | | 20/02/12 | 12:01:41 | 8.8 |
| | | 20/02/12 | 12:03:41 | 6.9 |
| | | 28/02/12 | 17:24:21 | 6.5 |
| | | 28/02/12 | 17:25:44 | 6.4 |
| | | 18/05/12 | 16:53:38 | 6.0 |
| | | 18/05/12 | 16:54:39 | 6.6 |
| Yeoman Street 2 (EPSS3) | 536194, 178790 | 28/08/11 | 08:18:35 | 0.0 |
| | | 28/08/11 | 08:19:04 | 0.0 |
| | | 30/10/11 | 08:43:43 | 0.0 |
| | | 30/10/11 | 12:31:37 | 8.6 |
| | | 01/12/11 | 12:32:32 | 8.0 |
| | | 20/02/12 | 12:05:01 | 6.6 |
| | | 20/02/12 | 12:05:55 | 6.0 |

| Location | Grid reference | Date | Time | $H_2S$ concentration ($\mu g/m^3$) |
|---|---|---|---|---|
| | | 28/02/12 | 17:27:08 | 5.9 |
| | | 28/02/12 | 17:28:04 | 5.9 |
| | | 18/05/12 | 16:56:22 | 7.2 |
| | | 18/05/12 | 16:57:24 | 6.4 |
| Croft Street (No. 62) (EPSS4) | 536136, 178740 | 28/08/11 | 08:14:18 | 0.0 |
| | | 28/08/11 | 08:14:48 | 0.0 |
| | | 30/10/11 | 08:40:54 | 4.7 |
| | | 30/10/11 | 08:41:22 | 5.2 |
| | | 01/12/11 | 12:25:31 | 9.8 |
| | | 01/12/11 | 12:26:16 | 8.8 |
| | | 20/02/12 | 11:55:28 | 7.2 |
| | | 20/02/12 | 11:57:09 | 6.6 |
| | | 28/02/12 | 17:21:11 | 7.7 |
| | | 28/02/12 | 17:22:09 | 7.3 |
| | | 18/05/12 | 16:49:44 | 6.8 |
| | | 18/05/12 | 16:51:04 | 6.7 |
| Meteorological conditions:<br>28/08/11 SW wind up to 2m/s, partially cloudy, rain on previous day.<br>30/10/11 SW wind at 0.5m/s, cloudy, last rain on 27/10/11.<br>01/12/11 W wind at up to 2.8m/s, cloudy and dry.<br>20/02/12 S and W wind up to 5.5m/s, partially cloudy.<br>18/05/12 S wind, average speed 0.7m/s. | | | | |

### Receptors

4.4.14 As set out in Section 4.1 and Vol 2 Section 4, the air quality assessment comprises a number of components including effects on local air quality (from construction road traffic and construction plant), effects from construction dust and operational odour effects. Each of these assessments involves the selection of appropriate receptors, which are detailed in Vol 22 Figure 4.4.3 (see separate volume of figures) and the table below (Vol 22 Table 4.4.6) for the Earl Pumping Station site. All of these receptors are relevant, albeit with different levels of sensitivity. The sensitivity of identified receptors has been determined using the criteria detailed in Vol 2 Section 4.

4.4.15 The receptors selected for the construction related volatile contaminant emissions are the same as those selected for the air quality assessment within that assessment area.

4.4.16 It is noted that Vol 22 Table 4.4.6 includes receptors associated with the proposed developments at Yeoman Street, Marine Wharf West, Cannon Wharf and Tavern Quay as appropriate for consideration in the air quality and odour assessments.

**Vol 22 Table 4.4.6 Air quality and odour – receptors**

| Receptors (relating to all identified emissions sources) | Approximate distance and direction from site | Receptor sensitivity | | |
|---|---|---|---|---|
| | | Air quality (construction traffic and construction plant) | Construction dust (on-site demolition and construction processes) | Odour (ventilation column) |
| Residential properties - Cannon Wharf (EPSR13)* | Adjacent | High (exposure relevant to annual mean, daily mean and hourly mean standards). | Medium | High |
| Residential properties - Yeoman Street (EPSR6)* | 10m east | Not applicable as the development will still be under construction in Site Year 1 of construction | | High |
| Residential properties - Chilton Grove (EPSR4) | 10m north | High (exposure relevant to annual mean, daily mean and hourly mean standards). | Medium | High |
| Residential properties - Croft Street (EPSR5) | 20m west | High (exposure relevant to annual mean, daily mean and hourly mean standards). | Medium | High |
| Residential properties - Yeoman Street (EPSR3) | 55m north | High (exposure relevant to annual mean, daily mean and hourly mean standards). | Medium | High |
| Residential properties - Plough Way (EPSR2) | 95m northeast | High (exposure relevant to annual mean, daily mean and hourly mean standards). | Medium | High |
| Residential - Marine Wharf West (EPSR11)* | 100m east | Not applicable as the development will still be under construction in Site Year 1 of construction | | High |
| Residential - Tavern Quay | 150m northeast | High (exposure relevant to annual | Medium | High |

| Receptors (relating to all identified emissions sources) | Approximate distance and direction from site | Receptor sensitivity | | |
|---|---|---|---|---|
| | | Air quality (construction traffic and construction plant) | Construction dust (on-site demolition and construction processes) | Odour (ventilation column) |
| (EPSR9)* | | mean, daily mean and hourly mean standards). | | |
| Educational - Deptford Park Primary School playground (EPSR17) | 330m south | Medium (exposure is relevant for the hourly mean standard only). | Medium | High |
| Educational - Deptford Park Primary School building (EPSR16) | 340m south | High (exposure relevant to annual mean, daily mean and hourly mean standards). | Medium | High |
| Other - Rose Court Care Home (EPSR15) | 160m southwest | High (exposure relevant to annual mean, daily mean and hourly mean standards). | Medium | High |
| Clinic – The Grove Medical Centre (EPSR12) | 300m southeast | Medium (exposure is relevant for the hourly mean standard only). | High | High |
| Commercial/retail - General Industrial and Storage Distribution (EPSR7) | 5m south | Low (exposure not relevant for the local air quality objectives). | Medium | Medium |
| Commercial - Lower Road / Evelyn Street (EPSR14) | 185m southwest | Low (exposure not relevant for the local air quality objectives). | Medium | Medium |
| Commercial - Plough Way (EPSR1) | 260m east | Low (exposure is relevant for the hourly mean standard only). | Medium | Medium |
| Recreational - Surrey Docks Water Sports Centre (EPSR8) | 175m north | Medium (exposure is relevant for the hourly mean standard only). | Medium | Medium |

| Receptors (relating to all identified emissions sources) | Approximate distance and direction from site | Receptor sensitivity | | |
|---|---|---|---|---|
| | | Air quality (construction traffic and construction plant) | Construction dust (on-site demolition and construction processes) | Odour (ventilation column) |
| Recreational - Theodorous South Dock Marina (EPSR10) | 395m northeast | Medium (exposure is relevant for the hourly mean standard only). | Medium | Medium |

** Denotes receptor that is altered or constructed after the baseline year.*

## Construction base case

4.4.17 The base case conditions for the construction assessment year would be expected to change from the baseline conditions due to modifications to the sources of the air pollution in the intervening period.

4.4.18 For road vehicles, there would be an increase in the penetration of new Euro emissions standards (Defra, 2012)[9] to the London vehicle fleet between the current situation and Site Year 1 of construction. Euro standards define the acceptable exhaust emission limits for new vehicles sold in the EU. These standards are defined through a series of European Union directives staging the progressive introduction of increasingly stringent standards over time. The uptake of newer vehicles with improved emission controls should lead to a reduction in $NO_2$ and $PM_{10}$ concentrations over time. These changes in fleet composition and the emissions are covered in this assessment.

4.4.19 Other emissions sources should also reduce due to local and national policies. Therefore, the non-road sources of the background concentrations used in the modelling have been reduced in line with Defra guidance LAQM.TG(09)[5]. Background pollutant concentrations for Site Year 1 of construction (peak construction year) used in the modelling are shown in Vol 22 Table 4.4.7.

4.4.20 The background $NO_2$ and $PM_{10}$ concentrations have been derived from the Defra mapped background data[6] as there are no suitable background monitoring sites within the relevant assessment area.

**Vol 22 Table 4.4.7 Air quality – annual mean background pollutant concentrations**

| Pollutant | Baseline (2010) | Peak construction year (Site Year 1 of construction) |
|---|---|---|
| $NO_2$ (µg/m$^3$)* | 35.9 | 28.2 |
| $PM_{10}$ (µg/m$^3$)* | 21.2 | 19.4 |

*Note: annual mean background pollutant concentrations used in the local air quality assessment. * Taken from the mean of the Defra mapped 1km grid squares centred on 535500, 178500 and 536500, 178500, adjusted to ensure local roads are not double-counted.*

4.4.21 As described in Section 4.3, the base case in Site Year 1 of construction takes into account two proposed developments, Cannon Wharf and Tavern Quay, including them as receptor locations in the air quality assessment. These are included in the receptor list provided in Vol 22 Table 4.4.6.

## Operational base case

4.4.22 Base case conditions have been assumed to be the same as baseline conditions with respect to background odour concentrations as no change in background odour concentrations is anticipated.

4.4.23 As described in Section 4.3, the base case for the odour assessment takes into account four proposed developments, Yeoman Street, Marine Wharf West, Cannon Wharf and Tavern Quay, including them as receptor locations. These are included in the receptor list provided in Vol 22 Table 4.4.6.

## 4.5 Construction effects assessment

### Local air quality assessment

4.5.1 Construction effects on local air quality (comprising emissions from construction road traffic and construction plant) have been assessed following the modelling methodology set out in Vol 2 Section 4. This involves predicting $NO_2$ and $PM_{10}$ concentrations in the baseline year (2010), and in the peak construction year (Site Year 1 of construction), without the proposed development (base case) and with the proposed development (development case). Predicted pollutant concentrations for the base case and development case can then be compared to determine the air quality impacts associated with the project and considering these in the context of statutory air quality objectives/limit values to determine and the significance of effects at specified receptors (listed in Vol 22 Table 4.4.6).

4.5.2 The assessment has focussed on $NO_2$ and $PM_{10}$ concentrations as these are the only pollutants whose air quality standards may be exceeded. From professional experience, emissions of other pollutants (eg, volatile organic compounds (VOCs)) are very unlikely to be significant and therefore do not need to be assessed.

4.5.3 A model verification exercise has been undertaken at the Earl Pumping Station site in line with the Defra guidance LAQM.TG(09) (Defra, 2009)[10]. This checks the model performance against measured concentrations, using the seven monitoring sites established for this assessment (EPSM1 – EPSM7 – see Vol 22 Table 4.4.2). Further details regarding the verification process are included in Vol 22 Appendix B.1. The model adjustment factor derived from the verification process was applied to all model results (for both $NO_2$ and $PM_{10}$).

4.5.4 The model inputs for the local air quality assessment for the Earl Pumping Station site are also detailed in Vol 22 Appendix B.2 and B.3. This includes road traffic data (comprising annual average daily traffic flows, heavy good vehicle proportions and speeds for each road link) and data pertaining to the construction plant.

### $NO_2$ concentrations

4.5.5 Predicted annual mean $NO_2$ concentrations for the modelled scenarios are shown in Vol 22 Table 4.5.1. This table details the forecast $NO_2$ concentrations at specific sensitive receptors. Annual mean results are shown for all of the sensitive receptors but the receptors are divided into two groups depending on whether the annual mean objective/limit value applies or not. The annual mean criteria only apply at those receptors which could be occupied continually for a year (eg, residential properties).

Exceedances of the hourly objective / limit value are inferred from the annual mean concentration. Additionally, contour plots are provided (Vol 22 Figures 4.5.1 - 4.5.3, see separate volume of figures) showing modelled concentrations for the baseline, base case and development case scenarios over the construction assessment area. A plot showing the change in $NO_2$ annual mean concentrations between the base and development cases (in the peak construction year) is also presented at Vol 22 Figure 4.5.4 (see separate volume of figures).

4.5.6 The modelled concentrations in Vol 22 Table 4.5.1 show that annual mean $NO_2$ levels are predicted to decrease between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. This decrease is due to predicted reductions in background concentrations and improved vehicle engine technology. The results for the development case show small increases over the base case at the majority of modelled receptors due to the construction works at the Earl Pumping Station site.

4.5.7 Exceedances of the annual mean objective / limit value (40µg/$m^3$) are predicted for all but one receptor in the baseline case. In the peak construction year, exceedances are predicted at six out of seventeen receptors. In line with LAQM.TG(09)[5], as modelled concentrations in the peak construction year are above 60µg/$m^3$ at the commercial properties on Lower Road (EPSR14) and Plough Lane (EPSR1), exceedences of the hourly $NO_2$ air quality objective / limit value are considered likely at these two receptors in both the base and development cases. At all other receptors it is not expected that the hourly objective / limit value would be exceeded.

**Vol 22 Table 4.5.1 Air quality – predicted annual mean $NO_2$ concentrations**

| **Receptor** | **Predicted annual mean $NO_2$ concentration (µg/$m^3$)** | | | **Change between base & dev case (µg/$m^3$)** | **Magnitude of impact** |
|---|---|---|---|---|---|
| | **2010 baseline** | **Peak construction year base case** | **Peak construction year dev case** | | |
| Receptors where the annual mean objective / limit value applies | | | | | |
| Cannon Wharf residential (EPSR13)* | **45.3** | 35.4 | 36.8 | 1.4 | Small |
| Chilton Grove residential (EPSR4) | **46.5** | 36.6 | 37.4 | 0.8 | Small |
| Croft Street residential (EPSR5) | **47.9** | 37.5 | 38.2 | 0.7 | Small |
| Yeoman Street residential | **51.2** | **40.5** | **41.3** | 0.8 | Small |

| Receptor | Predicted annual mean $NO_2$ concentration ($\mu g/m^3$) | | | Change between base & dev case ($\mu g/m^3$) | Magnitude of impact |
|---|---|---|---|---|---|
| | 2010 baseline | Peak construction year base case | Peak construction year dev case | | |
| (EPSR3) | | | | | |
| Plough Way residential (EPSR2) | **46.7** | 36.7 | 36.9 | 0.2 | Negligible |
| Tavern Quay residential (EPSR9)* | **41.2** | 32.3 | 32.3 | 0.0 | Negligible |
| Deptford Park Primary School building (EPSR16) | **55.8** | **43.3** | **43.5** | 0.2 | Negligible |
| Rose Court Care Home (EPSR15) | **66.6** | **54.1** | **54.5** | 0.5 | Small |
| Receptors where the annual mean objective / limit value does not apply | | | | | |
| Deptford Park Primary School playground (EPSR17) | **53.9** | **41.8** | **42.1** | 0.3 | Negligible |
| The Grove Medical Centre (EPSR12) | **41.6** | 32.4 | 32.4 | 0.0 | Negligible |
| General Industrial and Storage Distribution (EPSR7) | **45.7** | 35.9 | 38.0 | 2.1 | Medium |
| Lower Road/Evelyn Street commercial (EPSR14) | **88.3** | **74.1** | **74.4** | 0.3 | Negligible |
| Plough Way commercial (EPSR1) | **88.4** | **74.7** | **75.3** | 0.6 | Small |
| Surrey Docks Water Sports Centre (EPSR8) | **41.5** | 32.7 | 32.7 | 0.0 | Negligible |

| Receptor | Predicted annual mean $NO_2$ concentration ($\mu g/m^3$) | | | Change between base & dev case ($\mu g/m^3$) | Magnitude of impact |
|---|---|---|---|---|---|
| | 2010 baseline | Peak construction year base case | Peak construction year dev case | | |
| Theodorous South Dock Marina (EPSR10) | 39.1 | 30.6 | 30.7 | 0.1 | Negligible |

*Notes: Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m³ for the annual mean. Changes in concentration at each receptor have been rounded to one decimal place. * Denotes receptor that is altered or constructed after the baseline year.*

4.5.8 The highest increase in annual mean concentration as a result of the construction works at the Earl Pumping Station site is 2.1µg/m³ which is predicted at the General Industrial and Storage Distribution (EPSR7). However the annual mean objective / limit value (40µg/m³) does not apply at this receptor. The largest increase at a receptor of relevant exposure to the annual mean concentration is 1.5µg/m³ at the proposed residential properties at Yeoman Street (EPSR6). This increase is described as small magnitude according to the criteria detailed in Vol 2 Section 4.

4.5.9 The significance of the effect at residential properties at the proposed Cannon Wharf development (EPSR13), Chilton Grove (EPSR4), Croft Street (EPSR5), Yeoman Street (EPSR3) and Rose Court Care Home (EPSR15), which have a high sensitivity to local air quality is **minor adverse** (according to the criteria detailed in Vol 2 Section 4). The significance of the effect on the commercial properties on Plough Way (EPSR1), which has a low sensitivity to local air quality and at which the hourly objective / limit value applies, is **minor adverse**. All other receptors would have a **negligible** effect from $NO_2$.

### $PM_{10}$ concentrations

4.5.10 Predicted annual mean $PM_{10}$ concentrations for the modelled scenarios are shown in Vol 22 Table 4.5.2. This table details the forecast $PM_{10}$ concentrations at specific sensitive receptors. Additionally, contour plots are provided (Vol 22 Figures 4.5.5 - 4.5.7 – separate volume of figures) showing modelled concentrations for the baseline, base case and development case scenarios over the construction assessment area. A plot showing the change in annual mean $PM_{10}$ concentrations between the base and development cases (in the peak construction year) is also presented at Vol 22 Figure 4.5.8 (see separate volume of figures).

4.5.11 The modelled concentrations in Vol 22 Table 4.5.2 show that annual mean concentrations of $PM_{10}$ are predicted to achieve the annual mean objective / limit value (40µg/m³) and decrease or stay the same between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. The decreases are due to predicted reductions in background concentrations and improved vehicle engine technology.

**Vol 22 Table 4.5.2 Air quality – predicted annual mean $PM_{10}$ concentrations**

| Receptor | Predicted annual mean $PM_{10}$ concentration (µg/m$^3$) | | | Change between base & dev case (µg/m$^3$) | Magnitude of impact |
|---|---|---|---|---|---|
| | 2010 baseline | Peak construction year base case | Peak construction year dev case | | |
| Receptors where the annual mean objective / limit value applies | | | | | |
| Cannon Wharf residential (EPSR13)* | 22.6 | 20.5 | 20.7 | 0.2 | Negligible |
| Chilton Grove residential (EPSR4) | 22.8 | 20.6 | 20.7 | 0.1 | Negligible |
| Croft Street residential (EPSR5) | 23.0 | 20.8 | 20.9 | 0.1 | Negligible |
| Yeoman Street residential (EPSR3) | 23.6 | 21.2 | 21.2 | 0.0 | Negligible |
| Plough Way residential (EPSR2) | 22.9 | 20.6 | 20.7 | 0.0 | Negligible |
| Tavern Quay residential (EPSR9)* | 21.9 | 20.0 | 20.0 | 0.0 | Negligible |
| Deptford Park Primary School building (EPSR16) | 24.6 | 22.1 | 22.2 | 0.0 | Negligible |
| Rose Court Care Home (EPSR15) | 27.0 | 23.8 | 23.9 | 0.0 | Negligible |
| Receptors where the annual mean objective / limit value does not apply | | | | | |
| Deptford Park Primary School playground (EPSR17) | 24.3 | 21.9 | 21.9 | 0.0 | Negligible |

| Receptor | Predicted annual mean $PM_{10}$ concentration ($\mu g/m^3$) | | | Change between base & dev case ($\mu g/m^3$) | Magnitude of impact |
|---|---|---|---|---|---|
| | 2010 baseline | Peak construction year base case | Peak construction year dev case | | |
| The Grove Medical Centre (EPSR12) | 22.1 | 20.1 | 20.1 | 0.0 | Negligible |
| General Industrial and Storage Distribution (EPSR7) | 22.7 | 20.6 | 20.9 | 0.3 | Negligible |
| Lower Road/Evelyn Street commercial (EPSR14) | 32.8 | 28.1 | 28.1 | 0.0 | Negligible |
| Plough Way commercial (EPSR1) | 32.4 | 27.5 | 27.6 | 0.0 | Negligible |
| Surrey Docks Water Sports Centre (EPSR8) | 22.0 | 20.0 | 20.0 | 0.0 | Negligible |
| Theodorous South Dock Marina (EPSR10) | 21.6 | 19.8 | 19.8 | 0.0 | Negligible |

*Notes: Changes in concentration at each receptor have been rounded to one decimal place. * Denotes receptor that is altered or constructed after the baseline year.*

4.5.12 The predicted results for the development case show negligible increases over the base case at all modelled receptors due to construction activities at the Earl Pumping Station site. The highest predicted increase in annual mean concentration as a result of the construction is 0.3µg/m$^3$ which is predicted at the commercial/retail property at General Industrial and Storage Distribution (EPSR7). The highest predicted increase in annual mean concentration at a residential property is 0.2 µg/m$^3$ at Cannon Wharf proposed development adjacent to the southern boundary of the Earl Pumping Station (EPSR13). This increase in annual mean concentration is described as negligible magnitude according to the criteria detailed in Vol 2 Section 4.

4.5.13 With no exceedances of the annual mean $PM_{10}$ objective / limit value, the significance of the effects is **negligible** at all receptors**.**

4.5.14 With regard to the daily mean $PM_{10}$ concentrations, Vol 22 Table 4.5.3 shows the predicted number exceedances of the daily $PM_{10}$ standard ($50 \mu g/m^3$) for each modelled scenario. The objective / limit value allows no more than 35 exceedances in a year.

**Vol 22 Table 4.5.3 Air quality – predicted exceedances of the daily $PM_{10}$ standard**

| Receptor | Predicted number of exceedances of the daily $PM_{10}$ standard | | | Change between base & dev case (days) | Magnitude of impact |
|---|---|---|---|---|---|
| | 2010 baseline | Peak construction year base case | Peak construction year dev case | | |
| Receptors where the objective / limit value does apply | | | | | |
| Cannon Wharf residential (EPSR13)* | 7 | 4 | 4 | 0 | Negligible |
| Chilton Grove residential (EPSR4) | 8 | 4 | 4 | 0 | Negligible |
| Croft Street residential (EPSR5) | 8 | 4 | 5 | 0 | Negligible |
| Yeoman Street, residential (EPSR3) | 9 | 5 | 5 | 0 | Negligible |
| Plough Way residential (EPSR2) | 8 | 4 | 4 | 0 | Negligible |
| Tavern Quay residential (EPSR9)* | 6 | 3 | 3 | 0 | Negligible |
| Deptford Park Primary School building (EPSR16) | 11 | 7 | 7 | 0 | Negligible |
| Rose Court Care Home (EPSR15) | 18 | 10 | 10 | 0 | Negligible |
| Receptors where the objective / limit value does not apply | | | | | |
| Deptford Park Primary School playground (EPSR17) | 11 | 6 | 6 | 0 | Negligible |
| The Grove | 6 | 4 | 4 | 0 | Negligible |

| Receptor | Predicted number of exceedances of the daily $PM_{10}$ standard | | | Change between base & dev case (days) | Magnitude of impact |
|---|---|---|---|---|---|
| | 2010 baseline | Peak construction year base case | Peak construction year dev case | | |
| Medical Centre (EPSR12) | | | | | |
| General Industrial and Storage Distribution (EPSR7) | 8 | 4 | 5 | 0 | Negligible |
| Lower Road / Evelyn Street, commercial (EPSR14) | **39** | 21 | 21 | 0 | Negligible |
| Plough Way, commercial (EPSR1) | **37** | 19 | 19 | 0 | Negligible |
| Surrey Docks Water Sports Centre (EPSR8) | 6 | 3 | 3 | 0 | Negligible |
| Theodorous South Dock Marina (EPSR10) | 6 | 3 | 3 | 0 | Negligible |

*Notes: Emboldened figures indicate an exceedance of the objective / limit value which is 50µg/m$^3$ not to be exceeded more than 35 days in a year. * Denotes receptor that is altered or constructed after the baseline year. Changes at each receptor have been rounded to the nearest whole number.*

4.5.15 The results in Vol 22 Table 4.5.3 show that the number of daily exceedances of $PM_{10}$ is predicted to decrease between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. The decreases are due to predicted reductions in background concentrations and improved vehicle engine technology.

4.5.16 The results for the development case show no increase in concentrations above 50µg/m$^3$ compared with the base case at all modelled receptors. This represents an impact of negligible magnitude according to the criteria in Vol 2 Section 4.

4.5.17 With no exceedances of the daily $PM_{10}$ objective / limit value in the development case at relevant receptors, the significance of the effects is **negligible** at all receptors.

### Sensitivity test for programme delay

4.5.18 For the assessment of local air quality effects during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors. Based on the development schedule (Vol 22 Appendix N), it is possible that as a result of the one year delay, more of the Cannon Wharf development and part of the Yeoman Street and Marine Wharf West developments may be complete and occupied. However, it is not expected that any new receptors would experience different effects to those receptors assessed above, rather it would be a case of the potential for some additional receptors to experience the same effects to those that have already been identified.

## Construction dust

4.5.19 Construction dust would be generated from both on-site activities and from road vehicles accessing and servicing the site.

4.5.20 Dust sensitive receptors have been identified in the vicinity of the Earl Pumping Station site in accordance with the criteria in Vol 2 Section 4, as described in Vol 22 Table 4.4.6. A summary of the approximate numbers of receptors in distance bands from the Earl Pumping Station site is detailed in Vol 22 Table 4.5.4.

**Vol 22 Table 4.5.4 Air quality – numbers of dust sensitive receptors**

| Buffer distance (m) | Number of receptors* | Receptor type |
|---|---|---|
| <20 | 10-100 | Residential, commercial, industrial |
| 20-50 | 10-100 | Residential, commercial, industrial |
| 50-100 | 100-500 | Residential, commercial, open space |
| 100-350 | More than 500 | Residential, shops, financial and professional services, restaurants, offices, community facilities, sports centre |

** Buildings or locations that could be affected by nuisance dust.*

4.5.21 In line with the Institute of Air Quality Management (IAQM) guidance (IAQM, 2012)[11], the site has been categorised using the criteria given in Vol 2 Section 4 which assesses the likely impacts from demolition, earthworks, construction and trackout activities during construction and the likely effects of these activities on sensitive receptors close to the development.

4.5.22 The demolition for the Earl Pumping Station site is classified as a ‘small’ dust emission class. This classification is based on the small size of the demolition volumes, which is less than 4,000m$^3$. As the nearest receptor is less than 20m from the construction site, this makes the risk category for demolition activities medium risk.

4.5.23 The earthworks have been assessed to be a ‘medium’ dust emission class as the size of the construction site is between 2,500m$^2$ and 10,000m$^2$ and the total material to be moved is less than 100,000 tonnes. With the nearest receptor less than 20m away, the site is assessed to be high risk for earthworks.

4.5.24 The construction proposed for the Earl Pumping Station site has a 'medium' dust emission class. This classification is based on the small size of the building volumes and the use of on-site concrete batching. The risk category for construction activities is therefore assessed to be high risk due to the proximity of the closest receptors.

4.5.25 There would be 50-100m of unpaved haul roads on site, and the number of construction lorries per day would be 25-100 so the trackout dust emission class is classified as 'medium'. The closest receptor is within 20m of the affected roads. The risk category from trackout is therefore assessed to be medium risk.

4.5.26 The risk categories for the four activities are summarised in Vol 22 Table 4.5.5. This summary of these risks does not take into account the measures outlined in the *CoCP* Part A (Section 7).

**Vol 22 Table 4.5.5 Air quality – construction dust risks**

| Source | Dust soiling / $PM_{10}$ effects |
|---|---|
| Demolition | Medium risk site |
| Earthworks | High risk site |
| Construction | High risk site |
| Trackout | Medium risk site |

*Note: without CoCP measures*

4.5.27 On this basis, the development at the Earl Pumping Station site is classified as a high risk site overall.

4.5.28 Although the sensitivity of the majority of the receptors (with respect to construction dust nuisance) is identified as medium (as identified in Vol 22 Table 4.4.6), due to the duration of the works and the other developments being constructed in the area, the overall sensitivity of the area has been defined as 'very high'.

4.5.29 With regard to the significance of effects, a high risk site with a very high sensitivity of the area would result in an overall major adverse effect without control measures. When the measures outlined in the *CoCP* Part A (Section 7) are applied, the significance of the effect would be reduced to **minor adverse** for receptors within 50m of the site boundary (in accordance with IAQM guidance[11]). The significance of construction dust effects at receptors greater than 50m from the site boundary would be **negligible** with the *CoCP* Part A (Section 7) measures. The significance of the effect for each receptor is summarised in Vol 22 Table 4.5.6.

**Vol 22 Table 4.5.6 Air quality – significance of construction dust effects**

| Receptor | Significance of effect |
|---|---|

| | |
|---|---|
| Cannon Wharf residential (EPSR13)* | Minor adverse |
| Chilton Grove residential (EPSR4) | Minor adverse |
| Croft Street residential (EPSR5) | Minor adverse |
| Yeoman Street residential (EPSR3) | Negligible |
| Plough Way residential (EPSR2) | Negligible |
| Tavern Quay residential (EPSR9)* | Negligible |
| Deptford Park Primary School playground (EPSR17) | Negligible |
| Deptford Park Primary School building (EPSR16) | Negligible |
| Rose Court Care Home (EPSR15) | Negligible |
| The Grove Medical Centre (EPSR12) | Negligible |
| General Industrial and Storage Distribution (EPSR7) | Minor adverse |
| Lower Road / Evelyn Street commercial (EPSR14) | Negligible |
| Commercial, Plough Way (EPSR1) | Negligible |
| Surrey Docks Water Sports Centre (EPSR8) | Negligible |
| Theodorous South Dock Marina (EPSR10) | Negligible |

** Denotes receptor that is altered or constructed after the baseline year.*

## Construction related volatile contaminant emissions

4.5.30 The results from the air quality modelling of naphthalene emissions are shown in Vol 22 Table 4.5.7. The results can be compared with the World Health Organisation guideline set to protect human health of 10µg/m$^3$ for an annual mean. The table also identifies the magnitude of the identified impacts in accordance with the criteria detailed in Vol 2 Section 4.

**Vol 22 Table 4.5.7 Air quality – predicted naphthalene concentrations**

| Receptor | Peak construction year dev case | Magnitude of impact |
|---|---|---|
| Receptors where the annual mean objective guideline applies | | |
| Cannon Wharf residential (EPSR13)* | 0.0 | Negligible |
| Chilton Grove residential (EPSR4) | 0.6 | Medium |
| Croft Street residential (EPSR5) | 0.5 | Medium |
| Yeoman Street residential (EPSR3) | 0.1 | Small |

| Receptor | Peak construction year dev case | Magnitude of impact |
|---|---|---|
| Plough Way residential (EPSR2) | 0.1 | Small |
| Tavern Quay residential (EPSR9)* | 0.0 | Negligible |
| Deptford Park Primary School building (EPSR16) | 0.0 | Negligible |
| Rose Court Care Home (EPSR15) | 0.0 | Negligible |
| Receptors where the annual mean guideline does not apply | | |
| Deptford Park Primary School playground (EPSR17) | 0.6 | Medium |
| The Grove Medical Centre (EPSR12) | 0.0 | Negligible |
| General Industrial and Storage Distribution (EPSR7) | 0.6 | Medium |
| Lower Road/Evelyn Street commercial (EPSR14) | 0.0 | Negligible |
| Plough Way commercial (EPSR1) | 0.0 | Negligible |
| Surrey Docks Water Sports Centre (EPSR8) | 0.0 | Negligible |
| Theodorous South Dock Marina (EPSR10) | 0.0 | Negligible |
| Highest off-site concentration | 1.6 | Large |

** Denotes receptor that is altered or constructed after the baseline year.*

4.5.31 The health based air quality guideline for naphthalene is not exceeded, with the highest modelled concentration at a receptor being 0.6µg/m$^3$ which is well within the guideline of 10µg/m$^3$ and is of medium magnitude. The highest off-site concentration is 1.6µg/m$^3$ which is of large magnitude.

4.5.32 The results from the odour modelling of naphthalene emissions are shown in

4.5.33 Vol 22 Table 4.5.8. The results are compared with the odour benchmark set by the Environment Agency, results are presented for the 98$^{th}$ percentile of hourly average concentrations in the year (or the 176$^{th}$ highest hourly concentration in the year) and the number of hours in a year with concentrations above 1.5ou$_E$/m$^3$. The number of hours with concentrations above 1.5ou$_E$/m$^3$ gives an indication of the number of hours in a year that an odour might be detectable at the worst affected receptor. The table also identifies the magnitude of the identified impacts in accordance with the criteria detailed in Vol 2 Section 4.

**Vol 22 Table 4.5.8 Odour – predicted odour concentrations**

| Receptor | Peak construction year dev case | | Magnitude of impact |
|---|---|---|---|
| | No. of hours > 1.5$ou_E/m^3$ | 98th percentile odour concentration ($ou_E/m^3$) | |
| Plough Way commercial (EPSR1) | 0 | 0.0 | Negligible |
| Plough Way residential (EPSR2) | 0 | 0.0 | Negligible |
| Yeoman Street residential (EPSR3) | 0 | 0.0 | Negligible |
| Chilton Grove residential (EPSR4) | 20 | 0.2 | Negligible |
| Croft Street residential (EPSR5) | 22 | 0.1 | Negligible |
| General Industrial and Storage Distribution (EPSR7) | 12 | 0.1 | Negligible |
| Surrey Docks Water Sports Centre (EPSR8) | 0 | 0.0 | Negligible |
| Tavern Quay residential (EPSR9)* | 0 | 0.0 | Negligible |
| Theodorous South Dock Marina (EPSR10) | 0 | 0.0 | Negligible |
| The Grove Medical Centre (EPSR12) | 0 | 0.0 | Negligible |
| Cannon Wharf residential (EPSR13)* | 0 | 0.0 | Negligible |
| Lower Road/Evelyn Street commercial (EPSR14) | 0 | 0.0 | Negligible |
| Rose Court Care Home (EPSR15) | 0 | 0.0 | Negligible |
| Deptford Park Primary School building (EPSR16) | 0 | 0.0 | Negligible |
| Deptford Park Primary School playground (EPSR17) | 24 | 0.1 | Negligible |
| Highest off-site concentration | 114 | 0.95 | Negligible |

** Denotes receptor that is altered or constructed after the baseline year.*

4.5.34 In the table above, the 98th percentile odour benchmark of 1.5$ou_E/m^3$ is not exceeded at all locations beyond the site boundary. The highest off-site concentration is 0.95$ou_E/m^3$ in Chilton Grove adjacent to the Pumping Station which is of negligible magnitude. An odour could be detectable at residential properties close to the site for up to 22 hours per year which is much less than that which could cause a nuisance.

4.5.35 The health based naphthalene air quality guideline is not exceeded, with the highest modelled concentration off-site being 1.6µg/$m^3$ which is well within the guideline of 10µg/$m^3$ but is of large magnitude. A medium magnitude impact would occur where people could be exposed at buildings and where the guideline would apply.

4.5.36 With regard to the significance of effects for odour given that the predicted odour concentrations at all locations would not exceed 1$ou_E/m^3$ for the 98th percentile criterion of 1.5$ou_E/m^3$, it is considered that overall significance would be **negligible**. No significant effects are therefore predicted in relation to naphthalene odour.

4.5.37 The significance of effects for naphthalene would be **negligible** given that the magnitude is medium at receptors where the guideline would apply as the concentrations are well within the guideline.. No significant effects are therefore predicted in relation to health effects from naphthalene.

## 4.6 Operational effects assessment

4.6.1 The operational assessment has been undertaken in accordance with the modelling methodology set out in Vol 2 Section 4. Vol 22 Table 4.6.1 shows the predicted maximum ground level odour concentrations at the Earl Pumping Station site. These are the highest concentrations that could occur at the worst affected ground level receptor at or near the site in a typical year. In accordance with the odour benchmark set by the Environment Agency, results are presented for the 98th percentile of hourly average concentrations in the year (or the 176th highest hourly concentration in the year) and the number of hours in a year with concentrations above 1.5$ou_E/m^3$. Achieving the 98th percentile is considered to prevent nuisance and protect amenity. The number of hours with concentrations above 1.5$ou_E/m^3$ gives an indication of the number of hours in a year that an odour might be detectable at the worst affected receptor. The Environment Agency benchmark permits 175 hours above 1.5$ou_E/m^3$. The table also identifies the magnitude of the identified impacts in accordance with the criteria detailed in Vol 2 Section 4.

**Vol 22 Table 4.6.1 Odour – impacts and magnitude – operation**

| Year | Maximum at ground level locations* | | Impact magnitude and justification |
|---|---|---|---|
| Typical | 98th percentile ($ou_E/m^3$) | 0 | Negligible<br>98th percentile concentration is less than 1$ou_E/m^3$ |
| | No. of hours > 1.5$ou_E/m^3$ | 6 | |

** Beyond site boundary*

4.6.2 In Vol 22 Table 4.6.1 above, the 98$^{th}$ percentile is shown as zero as air would be released from the ventilation column for less than 2% (176 hours) of the year. This means that the odour benchmark would be achieved at all locations. This represents an impact of negligible magnitude.

4.6.3 The highest odour concentrations are predicted to occur close to the ventilation column where odour would be above 1.5$ou_E/m^3$ for 15 hours in a typical year. The maximum impact occurs within the site boundary with the number of hours exceeding 1.5$ou_E/m^3$ reducing to a maximum of six hours off site adjacent to the site boundary. Odours would be detectable in Croft Street adjacent to the site and in Chilton Grove within 85m of the ventilation column and as such could be detectable at residential properties for one hour in the year.

4.6.4 With a frequent use year (ie, a more rainy year than average), the number of hours with releases would be higher but the amount of odour released would be lower, resulting in a slight increase in the number of hours exceeding 1.5$ou_E/m^3$ adjacent to the ventilation column on site but no change at the closest residential property to that predicted for the typical year.

4.6.5 With regard to the significance of effects given that the predicted odour concentrations at all locations would not exceed the 98$^{th}$ percentile benchmark of 1.5$ou_E/m^3$, it is considered that overall significance would be **negligible**. No significant effects are therefore predicted in relation to odour.

## 4.7 Cumulative effects assessment

### Construction effects

4.7.1 As described in Section 4.3, three developments, Yeoman Street, Cannon Wharf and Marine Wharf West, would be under construction during Site Year 1 of construction at the Earl Pumping Station site. The effect from the Marine Wharf West development is likely to be small and not affect the significance of the impacts during the construction activities at the Earl Pumping Station site due to the distance between the two sites. However, the construction at Yeoman Street and Cannon Wharf developments would be closer to the site and may affect dust concentrations at receptors in the vicinity of the Earl Pumping Station site. This cumulative effect has been taken into account by increasing the sensitivity of the area to construction dust. The traffic effects from these developments have already been accounted for in the traffic data used for the air quality assessment. Therefore the effects on air quality would remain as described in Section 4.5 above.

4.7.2 In the event that the programme for the Thames Tideway Tunnel is delayed by approximately one year, more of the Cannon Wharf development and some of the Yeoman Street and Marine Wharf West developments may be built and occupied which would lead to a corresponding reduced level of cumulative activity. Cumulative effects would therefore be no greater than described above.

### Operational effects

4.7.3 As described in Section 4.3, there would not be any cumulative operational effects. Therefore the effects on odour would remain as described in Section 4.6 above.

## 4.8 Mitigation

### Construction

4.8.1 Control measures of relevance to air quality are embedded in the *CoCP* Part A (Section 7) as summarised in Section 4.2. No mitigation is required because effects are not significant.

### Operation

4.8.2 Based on the assessment results (which includes the environmental design measures detailed in para. 4.2.18) indicating that all effects would be negligible, no mitigation is required.

### Monitoring

4.8.3 It is envisaged that an appropriate particulate monitoring regime would be agreed with the LB of Lewisham prior to commencement of construction at the Earl Pumping Station site.

## 4.9 Residual effects assessment

### Construction effects

4.9.1 As no mitigation measures are required, the residual construction effects remain as described in Section 4.5. All residual effects are presented in Section 4.10.

### Operational effects

4.9.2 As no mitigation measures are required, the residual operational effects remain as described in Section 4.6. All residual effects are presented in Section 4.10.

## 4.10 Assessment summary

**Vol 22 Table 4.10.1 Air quality – summary of construction assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Residential – Cannon Wharf (EPSR13)* | Local air quality – effects from construction road traffic and plant emissions | Minor adverse | None | Minor adverse |
| | Effects from construction dust | Minor adverse | None | Minor adverse |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Residential - Chilton Grove (EPSR4) | Local air quality – effects from construction road traffic and plant emissions | Minor adverse | None | Minor adverse |
| | Effects from construction dust | Minor adverse | None | Minor adverse |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Residential - Croft Street (EPSR5) | Local air quality – effects from construction road traffic and plant emissions | Minor adverse | None | Minor adverse |
| | Effects from construction dust | Minor adverse | None | Minor adverse |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Residential - Yeoman Street (EPSR3) | Local air quality – effects from construction road traffic and plant emissions | Minor adverse | None | Minor adverse |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Residential - Plough Way (EPSR2) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Residential - Tavern Quay (EPSR9)* | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Educational - Deptford Park Primary School playground (EPSR17) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Educational - Deptford Park Primary School building (EPSR16) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Other - Rose Court Care Home (EPSR15) | Local air quality – effects from construction road traffic and plant emissions | Minor adverse | None | Minor adverse |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Clinic – The Grove Medical Centre (EPSR12) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Commercial/retail, General Industrial and Storage Distribution (EPSR7) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Minor adverse | None | Minor adverse |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Commercial - Lower Road / Evelyn Street (EPSR14) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Commercial - Plough Way (EPSR1) | Local air quality – effects from construction road traffic and plant emissions | Minor adverse | None | Minor adverse |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Surrey Docks Water Sports Centre (EPSR8) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |
| Theodorous South Dock Marina (EPSR10) | Local air quality – effects from construction road traffic and plant emissions | Negligible | None | Negligible |
| | Effects from construction dust | Negligible | None | Negligible |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| | Local air quality – effects from excavation of contaminated land | Negligible | None | Negligible |
| | Odour from excavation of contaminated land | Negligible | None | Negligible |

** Denotes receptor that is altered or constructed after the baseline year.*

**Vol 22 Table 4.10.2 Odour – summary of operational assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Residential - Cannon Wharf (EPSR13)* | Odour | Negligible | None | Negligible |
| Residential - Yeoman Street (EPSR6)* | | Negligible | None | Negligible |
| Residential - Chilton Grove (EPSR4) | | Negligible | None | Negligible |
| Residential - Croft Street (EPSR5) | | Negligible | None | Negligible |
| Residential - Yeoman Street (EPSR3) | | Negligible | None | Negligible |
| Residential - Plough Way (EPSR2) | | Negligible | None | Negligible |
| Residential - Marine Wharf West (EPSR11)* | | Negligible | None | Negligible |
| Residential - Tavern Quay (EPSR9)* | | Negligible | None | Negligible |
| Educational - Deptford Park Primary School playground (EPSR17) | | Negligible | None | Negligible |
| Educational - Deptford Park Primary School building (EPSR16) | | Negligible | None | Negligible |
| Other - Rose Court Care Home (EPSR15) | | Negligible | None | Negligible |
| Clinic – The Grove Medical Centre (EPSR12) | | Negligible | None | Negligible |
| Commercial/retail - General Industrial and Storage Distribution (EPSR7) | | Negligible | None | Negligible |
| Commercial - Lower Road / Evelyn Street (EPSR14) | | Negligible | None | Negligible |
| Commercial - Plough Way (EPSR1) | | Negligible | None | Negligible |
| Surrey Docks Water Sports Centre (EPSR8) | | Negligible | None | Negligible |
| Theodorous South Dock Marina (EPSR10) | | Negligible | None | Negligible |

** Denotes receptor that is altered or constructed after the baseline year.*

# References

[1] Greater London Authority and London Councils, *Best Practice Guidance: The Control of Dust and Emissions from Construction and Demolition* (November 2006).

[2] Highways Agency, *Design Manual for Roads and Bridges, Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques*, Part 1 pg D-1 HA207/07 Air Quality, May 2007.

[3] Michigan Environmental Science Board, *Health Effects of Low-Level Hydrogen Sulfide in Ambient Air* (2000).

[4] UK Government, Environment Act 1995, http://www.legislation.gov.uk/ukpga/1995/25/contents. Accessed June 2012.

[5] Defra, *Local Air Quality Management- Technical Guidance, LAQM.TG(09)* (2009).

[6] Defra, http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html. Accessed June 2012.

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[8] World Health Organization, *Air Quality Guidelines for Europe,* Second Edition (2000), Chapter 6.6.

[9] Defra, http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft. Accessed June 2012.

[10] Defra, *Local Air Quality Management- Technical Guidance, LAQM.TG(09)* (2009).

[11] Institute of Air Quality Management, *Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance* (January 2012).

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**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 5: Ecology - aquatic

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

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January 2013

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Creating a cleaner, healthier River Thames

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 5: Ecology – aquatic

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# 5 Ecology – aquatic

## 5.1 Introduction

5.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on aquatic ecology at the Earl Pumping Station site.

5.1.2 Construction effects for aquatic ecology for this site have not been assessed. This is on the basis that there would be no in-river construction works associated with this site. Therefore no significant construction effects are considered likely and for this reason only information relating to operational effects on aquatic ecology are assessed.

5.1.3 There would also be no in-river operational works; however, during operation the interception of the combined sewer overflow (CSO) would result in reduced discharges of untreated sewage into the tidal reaches of the River Thames (tidal Thames) at the CSO discharge point.

5.1.4 The presence of sewage in the aquatic environment has adverse effects on aquatic ecology receptors (habitats, mammals, fish, invertebrates and algae). In particular, discharges of untreated sewage effluent can result in low levels of dissolved oxygen (DO), which can cause mass fish mortalities known as hypoxia events. There are CSOs discharging at locations throughout the tidal Thames, including the reach upstream and downstream of the Earl Pumping Station CSO.

5.1.5 The tidal Thames comprises a dynamic environment, in which tidal action leads to dispersal of discharges. Therefore, the effects of the operational Thames Tideway Tunnel, which is designed to intercept the most problematic CSOs, would be most evident at a project-wide level. These effects are therefore reported in Volume 3 Project-wide assessment. This section assesses the localised effects at a site-specific level for the Earl Pumping Station CSO discharge.

5.1.6 The assessment of the likely significant effects of the project on aquatic ecology has considered the requirements of the *National Policy Statement* (NPS) *for Waste Water* (Defra, 2012)[1]. In line with these requirements, designations, species and habitats relevant to aquatic ecology are identified and measures incorporated into the proposed development described. Based on assessment findings, measures to address likely significant adverse effects are identified. Vol.2 Section 5 provides further details on the methodology.

5.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

## 5.2 Proposed development relevant to aquatic ecology

5.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to aquatic ecology are set out below.

### Operation

5.2.2 Discharges from the Earl Pumping Station CSO would be intercepted at the Earl Pumping Station site as part of the project. Based on the base case (which includes permitted Thames Tideway Tunnel sewage treatment works upgrades, and the Lee Tunnel scheme, as well as projected population increases) discharges during the Typical Year[i] from the Earl Pumping Station CSO are anticipated be 594,000m$^3$ per annum over a total of 30 discharge events (or spills) by 2021. The discharge is predicted to reduce to 51,000m$^3$ per annum over four discharge events once the Thames Tideway Tunnel project is operational. This represents an approximately 91% decrease in the volume of discharge as a result of the Thames Tideway Tunnel project.

## 5.3 Assessment methodology

### Engagement

5.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. There were no site specific comments from consultees for this particular site relating to aquatic ecology.

### Baseline

5.3.2 The baseline methodology follows the methodology described in Vol 2. There are no site specific variations for identifying the baseline conditions for this site.

5.3.3 The assessment is based on survey and desk study data for habitats, fish, invertebrates and algae, and on background data for mammals. Desk study data has been obtained for the whole of the tidal Thames for habitats, mammals, fish, invertebrates, and algae. The data sets for fish, invertebrates and algae are based on fixed sampling locations at intervals through the tidal Thames. Sites as close to Earl Pumping Station as possible have been selected. Details of the background and data sets are provided in Vol 2.

5.3.4 Surveys for fish and invertebrates were undertaken during October 2010, with repeat surveys for invertebrates in May 2011, at Borthwick Wharf/ Deptford Storm Relief, approximately 1.2km downstream of the Earl Pumping Station CSO discharge site. During these surveys, the intertidal habitats present were recorded. As part of the project wide assessment,

[i] The ‘Typical Year’ represents the most ‘typical’ 12 month period of rainfall observed between 1970 and 2011 and is represented by the period from October 1979 to September 1980.

surveys for juvenile fish were also undertaken at five sampling locations along the tidal Thames six times between May and September 2011 the nearest sampling location to the site was at Bermondsey Wall East, approximately 3.7km upstream. Surveys for algae were undertaken at eight sampling locations in May 2012. The nearest sampling location to the site was at King Edward Memorial Park Foreshore located on the north bank approximately 2.8km upstream of Earl Pumping Station CSO. The survey comprised sampling of algae along a vertical transect of the river wall.

## Operation

5.3.5 The assessment methodology for the operation phase follows that described in Vol 2. The assessment area is the zone which lies within a 100m radius of the existing CSO discharge site. There are two assessment years for operational effects; Year 1 and Year 6. Year 1 is the year that the Thames Tideway Tunnel project would be brought into operation. Year 6 provides sufficient time after operation commences to allow the longer term effects on aquatic ecology to be assessed. There are no site specific variations for undertaking the operational assessment of this site.

5.3.6 Section 5.6 details the likely significant effects arising from the operation at Earl Pumping Station site. The effects of the interception of all of the CSOs within the Thames Tideway Tunnel project on aquatic ecology receptors at a river wide level are considered in Vol 3 Project wide assessment.

5.3.7 No schemes from the site development schedule (Vol 22 Appendix N) are considered relevant to the aquatic ecology base case. The development at Convoys Wharf, which would include a wharf with associated vessel moorings and a jetty, would be complete and operational by the first year of operation. It lies approximately 700m downstream of the Earl Pumping Station CSO discharge. It is not considered that this would alter the aquatic ecology baseline for the Earl Pumping Station site because there would be no impacts on water quality from the Convoys Wharf development. Landtake and hydraulic impacts associated with the structures may have impacts on aquatic ecology receptors in the immediate vicinity of the development, but it is not considered that such effects would extend to the area around the Earl Pumping Station CSO discharge site. All other developments are in-land, do not comprise in-river development, development adjacent to the river or development discharging into the river and therefore would not affect the aquatic ecology baseline.

5.3.8 There are no schemes in the site development schedule that could lead to a cumulative impact at the Earl Pumping Station site because there are none that comprise in-river development, development adjacent to the river or development discharging into the river. Therefore no cumulative impact assessment has been undertaken.

5.3.9 The assessment of operational effects also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

### Assumptions and limitations

5.3.10 The assumptions and limitations associated with this assessment are presented in Vol 2. Assumptions and limitations specific to this site are outlined below.

#### Assumptions

5.3.11 There are no assumptions specific to the assessment of Earl Pumping Station site.

#### Limitations

5.3.12 There are no site specific limitations.

## 5.4 Baseline conditions

5.4.1 The following section sets out the baseline conditions for aquatic ecology within and around the site. Future baseline conditions (base case) are also described.

### Current baseline

5.4.2 The following section sets out the existing baseline applicable to this site. The section begins with a discussion of any statutory (ie with a basis in law) or non-statutory (ie designated only through policy) sites designated for their nature conservation value. It then addresses habitats, followed by the species receptors associated with those habitats, namely mammals, fish, invertebrates and algae. This order is followed throughout the assessment sections.

#### Designations and habitats

5.4.3 This section sets out the designations and habitats applicable at the site specific level. Designations and habitats applicable at the project wide scale are assessed in Vol 3.

5.4.4 The tidal Thames is part of the proposed Thames Estuary Marine Conservation Zone (MCZ no. 5), the details of which were submitted to Government in early 2012. If adopted, it will be designated as a national statutory site under the Marine and Coastal Access Act 2009. The purpose of MCZs is to protect the full range of nationally important biodiversity, as well as certain rare and threatened species and habitats. Species include smelt (*Osmerus eperlanus*), European eel (*Anguilla anguilla*) and tentacled lagoon worm (*Alkmaria romijnii*) (Balanced Seas, 2011)[2]. The tidal Thames offers important spawning and migratory habitat for smelt, and migratory habitat for European eel.

5.4.5 There are no other international or national statutory sites (ie Sites of Special Scientific Interest or Local Nature Reserves) designated for aquatic ecology within the assessment area.

5.4.6 The Earl Pumping Station CSO discharges directly into the non-statutory River Thames and Tidal Tributaries Site of Importance for Nature

Conservation (Grade III of Metropolitan importance)[ii]. The SINC is designated by the Greater London Authority (GLA) and adopted by all boroughs which border the Thames. It recognises the range and quality of estuarine habitats including mudflat, shingle beach, reedbeds and the river channel. The SINC citation notes that over 120 species of fish have been recorded in the Tideway, though many of these are only occasional visitors. The more common species include dace (*Leuciscus leuciscus*), bream (*Abramis brama*) and roach (*Rutilus rutilus*) in the freshwater reaches (described in para. 5.4.8), and sand-smelt (*Atherina presbyter*), flounder (*Platichtyhys flesus*) and Dover sole (*Solea solea*) in the estuarine reaches. Important migratory species include Twaite shad (*Alosa fallax*), European eel, smelt, salmon (*Salmo salar*) and sea trout (*Salmo trutta*). A number of nationally rare snails occur, including the swollen spire snail *Mercuria confusa*, as well as an important assemblage of wetland and wading birds.

5.4.7 The tidal Thames is the subject of a Habitat Action Plan (HAP) within the London Biodiversity Action Plan (BAP) (Thames Estuary Partnership Biodiversity Action Group, undated)[3], and the targets prescribed for this HAP are reflected in the London Borough (LB) of Lewisham HAP (Defra, 2012)[4]. The tidal Thames HAP identifies a number of habitats and species which characterise the estuary, such as gravel foreshore, mudflat and saltmarsh. A number of these habitats and species, including mudflat, are also the subject of action plans under the UK BAP.

5.4.8 The river is divided into three zones within the tidal Thames HAP; freshwater, brackish and marine (Vol 3 Figure 3.4.1, see separate volume of figures). The brackish zone is equivalent to the category known as transitional waters or estuaries under the Water Framework Directive (WFD). Further details of the WFD river zone classifications can be found in Vol 3.

5.4.9 Earl Pumping Station CSO discharge point lies within the brackish zone of the river, which means that the fish and invertebrate communities which occur within the river at this location consist of freshwater tolerant marine species and salt-water tolerant freshwater species. Invertebrate diversity is generally lower than in the freshwater zone as species must be able to withstand some variations in salinity and a stressful environment. Stress is caused by the fluctuating tidal conditions, which means that flora and fauna have to be able to tolerate wide variations in their physical environment.

5.4.10 The Earl Pumping Station site lies within 200m of the Greenland Dock and St. George's Wharf Site of Importance for Nature Conservation (SINC Grade II of Borough Importance)[iii] which is designated for its waterfowl, particularly during the breeding season.

5.4.11 At Borthwick Wharf, the nearest site surveyed to the Earl Pumping Station CSO discharge site, the subtidal substrate was found to consist of a

[ii] SINC (Grade M) = Site of Importance for Nature Conservation (Grade III of Metropolitan importance)

[iii] SINC (Grade B) = Site of Importance for Nature Conservation (Grade II of Borough importance)

heavily scoured bed consisting of pebbles and cobbles. The habitats at Earl Pumping Station are considered to be comparable to those at Borthwick Wharf. The CSO discharge site is located within an area of the UK BAP priority habitat 'mudflats' (Natural England, undated)[5].

### Evaluation of designations and habitats for Earl Pumping Station

5.4.12 The value of the habitats for individual aquatic ecology receptors is described in the relevant baseline sections. Habitats are considered to be of medium-high (metropolitan) value as part of the River Thames and Tidal Tributaries SINC (Grade M).

## Marine mammals

5.4.13 Records compiled by the Zoological Society of London for 2003-2011 indicate that harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*) and various seal species (grey seal (*Halichoerus grypus*) and common seal (*Phoca vitulina*)) migrate through the tidal Thames. No specific habitat of value for marine mammals is believed to occur within the vicinity of the site.

### Evaluation of marine mammals for Earl Pumping Station

5.4.14 The CSO site is considered to be of low-medium (local) value for marine mammals given the absence of records. There is no evidence of use as a haul out site by seals.

## Fish

5.4.15 In general, tidal Thames fish populations are mobile and wide ranging. Although the abundance and diversity of fish at any one site may provide some indication of the habitat quality offered at that site it is important to consider the data within the context of sites throughout the tidal Thames, since the factors influencing distribution are likely to be acting at this wider scale. To this end, the findings of the Thames Tideway Tunnel project site specific survey, relevant juvenile fish surveys and Environment Agency (EA) background data are presented in this section and are used to inform the evaluation of the site. Effects at the project-wide scale are assessed in Vol 3.

### Baseline surveys

5.4.16 A single day survey was undertaken at Borthwick Wharf (Deptford Storm Relief CSO) located approximately 1.2km downstream of the Earl Pumping Station CSO, during October 2010. The area covered by the survey is illustrated in Vol 23 Figure 5.4.1 (see separate Depford Church Street volume of figures). Full details of the methodology and rationale for timing of surveys are presented in Vol 2.

5.4.17 Fish are routinely categorised into four guilds according to their tolerance to salinity and habitat preference (Elliott and Hemingway, 2002[6] , Elliott and Taylor, 1989)[7] which can be defined as follows:

a. Freshwater – species which spend their complete lifecycle primarily in freshwater

b. Estuarine resident – species which remain in the estuary/transitional water for their complete lifecycle).

c. Diadromous – species which migrate through the estuary to spawn having spent most of their life at sea.

d. Marine juvenile – species which spawn at sea but spend part of their lifecycle in the estuary.

5.4.18 The survey recorded low to moderate fish abundance, with 66 individuals captured in total. The range of species recorded and the number of individuals is presented in Vol 22 Table 5.4.1. This ranked in the middle of the 15 sampling locations along the tidal Thames. The lowest catch (at Albert Embankment) was of 19 individuals. Six species were identified at Deptford Storm Relief CSO, the majority being smelt and common goby (*Pomatoschistus microps*).

**Vol 22 Table 5.4.1 Aquatic ecology – results of autumn 2010 fish surveys at Deptford Storm Relief CSO discharge site**

| Common name | Scientific name | Number of individuals | Guild |
|---|---|---|---|
| Smelt | *Osmerus eperlanus* | 26 | Diadromous |
| Common goby | *Pomatoschistus microps* | 18 | Estuarine resident |
| Common bream | *Abramis brama* | 12 | Freshwater |
| Flounder | *Platichthys flesus* | 8 | Estuarine resident |
| Sand smelt | *Atherina presbyter* | 1 | Estuarine resident |
| Sea bass | *Dicentrarchus labrax* | 1 | Estuarine resident |

5.4.19 This site reflects a widespread saline-tolerant fish community, except for the common ('freshwater') bream which may reflect the proximity of the site to the confluence with the Deptford Creek (approximately 0.3km distant).

### Juvenile fish surveys

5.4.20 The shallow river margins, which shift across the intertidal foreshore with the ebb and flood of the tides, provide an important migration route for juvenile fish along the estuarine corridor. The young of species such as eel (known as glass eels or elvers), flounder, dace and smelt rely upon access to these areas of lower water velocity to avoid being washed out by tides and to avoid predation by the larger fish that occur in deeper water. Young fish also feed predominantly amongst the intertidal habitat. Adult migrants of larger fish tend to use faster mid-channel routes.

5.4.21 Surveys for juvenile fish were undertaken as part of a suite of five sites, sampled six times between May and September 2011 as part of the project wide assessment. The nearest sampling site to Earl Pumping

Station is at Bermondsey Wall East, approximately 3.3km upstream. The findings give context to the assemblage of fish that may be expected to be found in this broad reach of the river. The site locations are presented in Vol 2 Figure 4.4.5 (see separate volume of figures). The aim of the surveys was to record juvenile fish migrations through the tidal Thames to inform a study of the hydraulic effects of the temporary and permanent structures on fish migration. The extent of the surveys and details of the methodology are presented in Vol 2.

5.4.22 The data from the juvenile fish surveys at the Bermondsey Wall East are shown in Vol 22 Table 5.4.2.

**Vol 22 Table 5.4.2 Aquatic ecology – results of 2011 juvenile fish surveys at Bermondsey Wall East**

| Common name | Scientific name | Number of individuals | | | | | |
|---|---|---|---|---|---|---|---|
| | | Survey | | | | | |
| | | 1 May | 2 late May | 3 June | 4 July | 5 Aug | 6 Sept |
| Flounder | *Platichthys flesus* | 1 | 7 | 102 | 16 | 1 | 10 |
| Smelt | *Osmerus eperlanus* | 1 | 2 | 0 | 0 | 0 | 0 |
| Eel | *Anguilla anguilla* | 0 | 3 | 2 | 4 | 1 | 3 |
| Common bream | *Abramis brama* | 0 | 0 | 0 | 7 | 0 | 5 |
| Dace | *Leuciscus leuciscus* | 0 | 2 | 0 | 0 | 0 | 0 |
| Roach | *Rutilus rutilus* | 0 | 0 | 25 | 1 | 0 | 1 |
| Perch | *Perca fluviatilis* | 0 | 0 | 0 | 7 | 0 | 0 |
| Goby | *Pomatoschistus spp.* | 0 | 0 | 2 | 262 | 457 | 330 |
| Sea bass | *Dicentrarchus labrax* | 0 | 0 | 0 | 247 | 14 | 4 |
| 3-spined stickleback | *Gasterosteus aculeatus* | 0 | 0 | 1 | 0 | 0 | 0 |
| Zander | *Stizostedion lucioperca* | 0 | 0 | 0 | 2 | 2 | 1 |
| Sand smelt | *Atherina presbyter* | 0 | 0 | 0 | 2 | 1 | 0 |

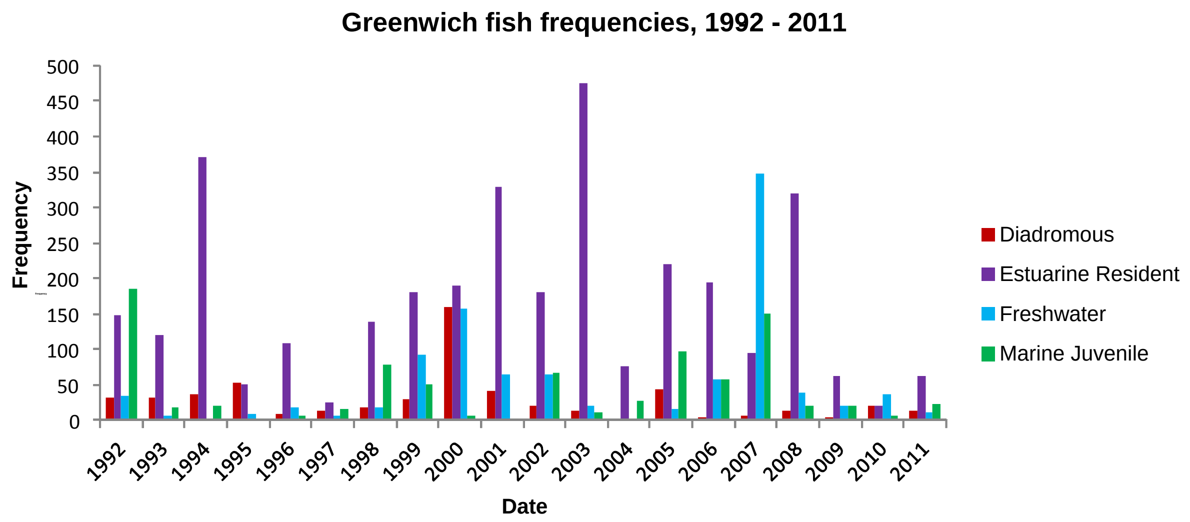
5.4.23 Post-larval flounders dominated the catch during survey three. Flounder were caught in the shallow littoral zone, indicating early springtime colonisation from marine spawning sites. In survey four, sea bass (*Dicentrarchus labrax*) and gobies were numerous, with numbers of gobies remaining high in surveys five and six. This indicates that Bermondsey Wall East is of importance for juvenile fish and that this broad stretch of the river is of value for juveniles, if not for adults.

### Environment Agency (EA) background data

5.4.24 The EA carry out annual surveys for fish within the tidal Thames using a variety of methods including trawling and seine netting, with data available from 1992 to 2011. The nearest sampling site to the Earl Storm Relief discharge is Greenwich, 2km downstream.

5.4.25 Results from Greenwich show fairly consistent catches in trawls but some indication of increasing seine-net catches in recent years. Catches are dominated by estuarine resident fish (Vol 22 Plate 5.4.1) such as common goby, flounder and sand smelt, freshwater species including dace, common bream, perch (*Perca fluviatilis*) and roach, and migratory species including eel and smelt. Other migratory species such as salmon and sea trout must pass through the area but are too infrequent to be detected by only one or two surveys per year. The assemblage of species recorded during the juvenile fish surveys at Bermondsey Wall East is similar to those recorded in the EA surveys as Greenwich, except for the relatively small number of smelt; however, since the EA data is from a site several kilometres away, the lack of exact correspondence is unsurprising. The high frequency of freshwater species recorded in 2007 may be as a result of very high rainfall during that year. High flows may have led to a greater number of freshwater fish being washed into the tidal Thames and lower salinity conditions which allowed them to survive.

**Vol 22 Plate 5.4.1 Aquatic ecology – long-term EA total fish catches from Greenwich site**



### Water quality and current fish baseline

5.4.26 Prior to the 1960s, water quality in the tidal Thames was heavily degraded by raw sewage inputs caused by under-capacity of sewage treatment works (STWs). With the construction of new works (Wheeler, 1979)[8], the progressive improvement of fish populations from the 1960s onwards was recorded. The ecology of the tidal Thames has undergone further improvement in recent decades, with some 125 fish species now recorded by the EA.

5.4.27 However, hypoxia events (see para. 5.1.4) arising from regular CSO spills and occasional discharges of untreated waste from STWs still occur. Discharges have the effect of depleting DO (measured in mg/l) by the biological breakdown of organic matter in the discharge. This is referred to as biochemical oxygen demand (BOD). Substantial fish mortalities begin to occur when DO levels drop beneath 4mg/l. An example of the effects of a hypoxia event occurred in June 2011 in which approximately 26,000 fish were killed, across the tidal Thames assessment area, following a release of around 450,000 tonnes of untreated sewage. This incident is discussed in further detail in the project wide assessment (Vol 3 Section 4)

5.4.28 The Tideway Fish Risk Model (TFRM) was developed to evaluate DO standards for the tidal Thames (Turnpenny *et al*, 2004)[9] as part of the Thames Tideway Strategic Study (TTSS). The DO standards for the tidal Thames comprise four threshold levels expressed as concentrations of DO in mg/l over specified tidal durations. Frequencies are set on the number of times per year each of these thresholds can be exceeded. Further details of the standards are presented in Vol 2 Section 14. Details of the TFRM are presented in Vol 2 and Vol 2 Appendix C.3. The TFRM considers fish distribution and the effects of low DO conditions within defined 3km zones within the tidal Thames. The zones are based on those used by the EA's automated water quality monitoring system (AQMS), for which DO data are collected continuously.

5.4.29 The model uses known hypoxia tolerance thresholds for seven species which are considered to represent the range of species which occur in the tidal Thames. The model is based on the assumption that most species of fish populations will be sustainable provided hypoxia related mortality does not exceed 10% of the total population. The model considers both adult and juvenile fish (known as 'lifestage cases'), since juveniles generally have a lower tolerance to hypoxia.

5.4.30 It is not possible to isolate the contribution of individual CSO discharges on hypoxia related fish mortalities in the tidal Thames. This is because the TFRM provides outputs at a population level. For example, DO conditions may be below a lethal threshold in one zone known to be used by a particular species of fish. However, provided conditions are above the threshold in other zones such that 90% of the population are unharmed then conditions are considered to be sustainable. The outputs are discussed in further detail in the project wide assessment (Vol 3 Section 5.6). However, TFRM results for the existing baseline suggest that a total of five of the seven species/lifestage cases are expected to suffer unsustainable hypoxia related mortality in the tidal Thames each year. Given that the indicator species used in the model act as surrogates for a wider range of ecosystem components, other sensitive taxa are also likely to be unsustainable under this water quality regime.

#### Evaluation of fish community for Earl Pumping Station

5.4.31 The Earl Pumping Station CSO site is considered to be of medium-high (metropolitan) value for fish based on relatively high diversity of freshwater and estuarine species.

### Invertebrates

5.4.32 Benthic invertebrates are used in the freshwater, estuarine and marine environments as biological indicators of water and sediment quality since their diversity, abundance and distribution reflects natural or man-made fluctuations in environmental conditions. Species diversity is influenced by factors such as substrate and salinity. However high species diversity (or numbers of species) at any given site generally indicates good water and/or sediment quality, whilst low diversity may indicate poor quality.

5.4.33 Invertebrate populations and particularly those which occur in the water column (pelagic) are influenced by conditions throughout the estuary. The strongest influences on invertebrate distribution and density tend to be physical factors such as salinity, and substrate type followed by water quality and local habitat conditions.

#### Baseline surveys

5.4.34 Two single day surveys were undertaken at Deptford Storm Relief CSO, located 1.2km downstream of the Earl Pumping Station CSO: one during October 2010 and one during May 2011. The area covered by the survey is the same as that described for the fish survey above (paras. 5.4.16 to 5.4.19) and illustrated in Vol 23 Figure 5.4.1 (see Depford Church Street separate volume of figures). Further details of these methods can be found in Vol 2. Two intertidal and seven subtidal samples were taken during the October 2010 survey, and three intertidal and two subtidal samples during the May 2011 survey.

5.4.35 The invertebrates collected during the October 2010 field surveys are presented in Vol 22 Table 5.4.3. The invertebrates collected during the May 2011 field surveys are presented in Vol 22 Table 5.4.4. The Community Conservation Index (CCI) score (Chadd and Extence, 2004)[10] has been used to identify species of nature conservation importance. CCI classifies many groups of invertebrates of inland waters according to their scarcity and conservation value in Great Britain and relates closely to the Red Data Book (RDB) (Bratton, 1991[11], Shirt, 1987[12]) by attributing a score between 1 and 10. The higher the CCI score the more scarce the species and/or greater its conservation value.

**Vol 22 Table 5.4.3 Aquatic ecology – invertebrate fauna sampled at Deptford Storm Relief CSO October 2010**

| Taxa | CCI score | No. of individuals - subtidal samples | | | | | | | No. of individuals - intertidal samples | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample numbers** | | **Air lift D** | **Air lift 1** | **Air lift 2** | **Air lift 3** | **Air lift 4** | **Air lift A** | **Air lift B** | **Sweep net 1** | **Sweep net 2** |
| *Theodoxus fluviatilis* | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 0 | 0 |
| *Potamopyrgus antipodarum* | 1 | 15 | 0 | 0 | 0 | 0 | 100 | 350 | 0 | 0 |
| *Assiminea grayana* | 2 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 |
| *Radix balthica* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 110 | 0 | 0 |
| *Sphaeridae* | - | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| *Nereis diversicolor* | - | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 8 | 0 |
| Oligochaeta | 0 | 2 | 0 | 0 | 0 | 3 | 145 | 1500 | 2 | 0 |
| *Erpobdella testacea* | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 0 | 0 |
| *Crangon crangon* | 0 | 6 | 6 | 6 | 0 | 0 | 45 | 0 | 0 | 1 |
| *Eriocheir sinensis* | - | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Lekanesphaera hookeri* | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 |
| *Apocorophium lacustre* | 8 | 20 | 145 | 8 | 7 | 85 | 350 | 0 | 0 | 0 |
| *Corophium volutator* | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| *Gammarus* sp | - | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Gammarus zaddachi* | 1 | 6 | 0 | 0 | 0 | 0 | 100 | 140 | 0 | 1 |
| **Number of Taxa** | | **6** | **2** | **2** | **1** | **2** | **11** | **8** | **3** | **2** |

**Vol 22 Table 5.4.4 Aquatic ecology – invertebrate fauna sampled at Deptford Storm Relief CSO May 2011**

| Taxa | CCI score | No. of individuals - subtidal samples | | No. of individuals - intertidal samples | | |
|---|---|---|---|---|---|---|
| **Sample numbers** | | **Air lift1** | **Air lift 2** | **Kick sample** | **Sweep net 1** | **Sweep net 2** |
| *Potamopyrgus antipodarum* | 1 | 0 | 0 | 0 | 0 | 2 |
| Polychaeta | - | 84 | 2 | 3 | 150 | 100 |
| Oligochaeta | - | 0 | 4 | 0 | 50 | 75 |
| *Crangon crangon* | - | 1 | 0 | 0 | 2 | 1 |
| *Gammarus* sp | - | 1 | 0 | 0 | 0 | 0 |
| *Gammarus zaddachi* | 1 | 0 | 1 | 0 | 40 | 30 |
| *Gammarus tigrinus* | 1 | 0 | 0 | 0 | 1 | 0 |
| **Number of taxa** | **-** | **3** | **3** | **1** | **5** | **5** |

5.4.36 As at most other sites on the tidal Thames, the invertebrate community was species poor and lacking in pollution sensitive taxa particularly in the intertidal samples. In contrast to sites further upstream, the intertidal samples were characterised by particularly low invertebrate diversity and abundance, with two-three pollution tolerant taxa and less than 20 specimens per sample (the lowest abundance of all sites and diversity among the least diverse). Subtidal samples however had significantly more diverse and abundant invertebrate fauna than intertidal samples (7 and 10 taxa per sample). The most common species included *Radix balthica* (snails), *Sphaerium* spp. (pea mussels), Oligochaeta (worms) and *Gammarus zaddachi* (brackish water amphipod shrimp).

5.4.37 The samples taken in May 2011 show slightly higher abundances and diversity compared with October 2010, in the intertidal samples. However, overall, the invertebrate community is still characterised by low diversity and dominated by pollution tolerant groups Oligochaeta and Polychaeta worms. These apparently higher abundances and diversity in the intertidal samples in May are likely to be due to sampling and habitat variations. The presence of extensive areas of silt and mud (generally poor invertebrate habitat) is likely to explain the poor invertebrate diversity.

5.4.38 Disturbed conditions, poor habitat quality and/or water quality are likely to explain the relative difference between the invertebrate community in intertidal and subtidal areas. The only significant difference between subtidal samples taken near to the outfall (Sample AL-A, approximately 40m from the outfall) and further away (Sample AL-B, approximately 100m from the outfall) is the presence of *Theodoxus fluviatilis* (river neritid, relatively sensitive to pollution) in the latter, which may indicate local differences in water quality.

5.4.39 The low abundance or absence of taxa in the intertidal area is likely to be due to the very limited intertidal habitat at the site, the CSO within in the area and poor background water quality.

5.4.40 The majority of taxa present are brackish species, with varying tolerance of different levels of salinity from estuarine to near freshwater. These included *G. zaddachi* (a brackish species of shrimp) and *Crangon crangon* (shrimp, typical of estuarine and brackish conditions).

5.4.41 The only species of high nature conservation importance was *Apocorophium lacustre* (CCI 8) recorded in October 2010 but not in May 2011. It is a RDB species. It was only present in low numbers at the site and limited to subtidal samples. EA data have shown *A. lacustre* to be common in the tidal Thames, and therefore the relative value of the invertebrate community is not considered to be of higher value in this instance.

5.4.42 Chinese mitten crab (*Eriocheir sinensis*), an invasive species, was sampled in the subtidal zone of the site in October 2010, but not May 2011.

### Environment Agency (EA) background data

5.4.43 The EA sampling site at Greenwich, 2km downstream of the Earl Pumping Station CSO discharge site, has data taken using a number of techniques, including cores and kick sampling in the intertidal and day grab and core samples in the subtidal. Sampling at Greenwich was undertaken on an approximately monthly basis over the period 1989 and 1993 and 2006-2007.

5.4.44 A total of 35 taxa were recorded at Greenwich over the seven year period in which samples were collected. The taxa Oligochaeta (worms), which thrives in organically polluted conditions, was most abundant, together with other pollution tolerant species such as the snail *Potamopyrgus antipodarum,* Polychaeta worms (mostly *Boccardiella ligerica*), gastropod snails (*P. antipodarum* and Cochliopidae) and *G. zaddachi*.

5.4.45 In addition to the native *G. zaddachi*, the amphipod *Gammarus tigrinus*, of North American origin, was also relatively abundant in samples taken at Greenwich.

5.4.46 It is believed that this species arrived in English waters via ballast water from ships. It lives in fresh and brackish waters and populations can expand rapidly, outcompeting local amphipods. However, based on available data, it appears to be much less abundant than the native *G. zaddachi* within the Tideway.

5.4.47 The majority of taxa present at Greenwich are brackish species, with varying tolerance of different levels of salinity from estuarine to near freshwater. However, the increasing saline influence compared to upstream sites is demonstrated by the abundance of *Lekanesphaera hookeri* (a water louse) and various Polychaete worms (notably *B. ligerica* and *Marenzelleria viridis*), which are exclusively associated with estuarine or marine conditions.

### Water quality and current invertebrate baseline

5.4.48 The influence of water quality, and specifically CSO discharges was investigated through statistical analysis of the EA invertebrate background data, Thames Tideway Tunnel project baseline data, and EA water quality data. Although it was not possible to isolate trends over time at a site specific level, a number of observations were made that helps to identify the factors influencing invertebrate abundance and diversity. For example, certain species of Oligochaete worm, present at Borthwick Wharf, are indicative of polluted conditions because they are able to tolerate the low DO conditions and multiply rapidly in the enriched sediments.

5.4.49 The analysis is described in further detail in Vol 3 Section 5.4. The following summary is relevant to the brackish zone of the tidal Thames in which the Earl Pumping Station CSO site is located.

5.4.50 The varying level of salinity and saline fluctuations appear to be a dominant factor determining the diversity and structure of benthic invertebrate assemblages. The analysis showed that, in general, samples in the brackish zone were less diverse compared with samples taken in the freshwater zone. This concurs with previous research into the invertebrate community of the tidal Thames and other estuaries, which show diversity decreasing downstream as the saline influence increases (Bailey-Brock *et al*, 2002)[13]. This is generally attributed to the fact that relatively few invertebrates are adapted to considerable fluctuations in salinity. Other factors such as poor water quality and lack of habitat diversity, particularly in central London, are also likely to contribute.

5.4.51 Redundancy analysis (RDA)[iv] was used to compare the invertebrate dataset with water quality data for the period between 1992 and 2010. The analysis demonstrated the importance of environmental variables in determining the invertebrate communities in the Thames. It appears that dominance of either Gammaridae (sensitive to hypoxia) or Oligochaeta (more tolerant to hypoxia) is influenced by the DO concentrations and DO sags in the Thames, although other factors such as habitat are also highly important. Other invertebrate taxa also appeared to be affected by poor water quality (low DO) and/or saline intrusion, notably the insect group (mayflies), while other groups (essentially Polychaete and Oligochaete worms) were shown to be tolerant of these conditions.

#### Evaluation of invertebrate community for Earl Pumping Station

5.4.52 Earl Pumping Station CSO discharge site is considered to be of medium (borough) importance due to the likely dominance of the invertebrate community by a limited range of pollution tolerant species. Only a single species of conservation importance (*A. lacustre*) was recorded (at Borthwick Wharf 1.2km downstream), and it is ubiquitous within the tidal Thames.

### Algae

5.4.53 Algae occurs in the tidal Thames both in the water column and growing on the river wall and associated structures. The range of species which occur in the tidal Thames reflect salinity, habitat and environmental conditions.

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[iv] Redundancy analysis is a form of regression analysis which provides information on the influence of environmental variables on the composition/abundances of the invertebrates assemblages.

As well as their intrinsic value algal communities provide valuable habitat for invertebrates and juvenile fish. Algae are often used as an indicator of water quality, since nutrients associated with sewage promote the growth of certain species of algae. This assessment focuses on the algal communities which grow on the river wall and associated structures.

### Baseline surveys

5.4.54 A single day survey was undertaken in May 2012 at King Edward Memorial Park Foreshore, located approximately 2km upstream of Earl Pumping Station CSO discharge point on the northern bank of the tidal Thames. Only six species of algae were recorded of which *Blidingia minima* is overwhelmingly dominant. All species are widespread and abundant in the tidal Thames. All records are shown in Vol 22 Table 5.4.5.

**Vol 22 Table 5.4.5 Aquatic ecology – marine algae sampled at King Edward Memorial Park during 2012**

| Species | Survey observations | Species presence within the Thames Estuary |
|---|---|---|
| *Blidingia marginata* | Occasionally present on the river wall. | Widespread and abundant. |
| *Blidingia minima* | This species is dominant at all but the lowest level of the river wall. | Widespread and abundant. |
| *Cladophora glomerata* | Frequently present at the lowest level of the river wall. | Widespread and abundant. |
| *Rhizoclonium riparium* | Occasionally present on the lowest level of the river wall only. | Common in the estuary. |
| *Ulva compressa* | Occasionally present on the river wall. | Widespread and abundant. |
| *Vaucheria* sp. | Occasionally present on the river wall. | The *Vaucheria sp* recorded is most probably *Vaucheria compacta*, which occurs on the upper littoral levels on sea walls. Widespread in the tidal Thames. |

### Natural History Museum background data

5.4.55 Data was obtained from the Natural History Museum, London (NHM) that identifies records of marine algae received for the period from the early 1970s to 1999. Algae were recorded from a sampling location at Deptford Creek, approximately 1km downstream and the records all shown in Vol 22 Table 5.4.6.

**Vol 22 Table 5.4.6 Aquatic ecology – marine algae sampled at Deptford Creek between early 1970s and 1999**

| Species | Observations |
|---|---|
| *Blidingia marginata* | Upper littoral and supra-littoral, and floating structure just above the water-line. Widespread and abundant. |
| *Blidingia minima* | Upper littoral and supra-littoral, wood breakwaters and halophyte stems. Abundant in tidal Thames. |
| *Gayralia oxysperma* | Upper littoral on sea walls. |
| Rhizoclonium riparium | Upper mid-littoral levels on sea walls and occasionally on floating structures above the water-line. Common in the estuary. |
| *Ulva intestinalis* | Upper littoral levels on sea walls. Common in the estuary. |
| *Ulva prolifera* | Upper mid-littoral on sea walls and on floating structures above the water line. Widespread in the estuary. |
| *Urospora penicilliformis* | Upper littoral on sea walks and on floating structures above the water line. Common in the estuary. |

### Water quality and algal communities

5.4.56 Algae depend on the nutrients nitrate and phosphate for growth. Although these nutrients occur naturally in water bodies, they are also present in sewage. Discharges of untreated sewage can result in elevated levels of nutrients which can lead to excessive growth of algae. As these algae die and decompose they use up oxygen in the water resulting in hypoxia (para. 5.1.4). This process is known as eutrophication. Excessive levels of algae can disrupt other elements of the ecosystem by smothering them.

5.4.57 Studies of the pelagic algae (para. 5.4.53) of the tidal Thames to inform its classification for the WFD have concluded that the estuary is not eutrophic due to strong tidal flows (English Nature, 2001)[14]. However, historically poor water quality has had a considerable negative influence on the algal communities of the tidal Thames and the loss of pollution sensitive species. Improvements in sewage treatment since the 1960's have led to a gradual process of recovery (Tittley, 2009)[15], although pollution tolerant species such as the green algal species still dominate the community.

### Evaluation of algal community for Earl Pumping Station

5.4.58 None of the species recorded in Vol 22 Table 5.4.5 and Vol 22 Table 5.4.6 have protected or notable status (eg RDB species or UK or local BAP species). The algal populations are therefore given low-medium (local) value as only limited records of widespread species occur from this location.

## Aquatic ecology receptor values and sensitivities

5.4.59 Using the baseline set out in paras. 5.4.1 to 5.4.59 the value accorded to each receptor considered in this assessment is set out in Vol 22 Table

5.4.7. The definitions of the receptor values and sensitivities used in this evaluation are set out in Vol 2.

**Vol 22 Table 5.4.7 Aquatic ecology – summary of receptors and their values/sensitivities at Earl Pumping Station**

| Receptor | Value/sensitivity |
|---|---|
| Foreshore habitat (intertidal and subtidal) | Medium-high (metropolitan) |
| Mammals | Low-medium (local) |
| Fish | Medium-high (metropolitan) |
| Invertebrates | Medium (borough) |
| Algae | Low-medium (local) |

## Operational base case

5.4.60 The base case in Year 1 and Year 6 of operation would include the improvements at the five main sewage treatment works that discharge into the tidal Thames (Mogden, Beckton, Crossness, Long Reach and Riverside), and the Lee Tunnel project. TFRM modelling (Vol 3 Appendix C.3) has shown that at a river-wide level there would be significant reduction in the occurrence of mass or population level fish mortalities with these schemes (ie hypoxia events, which result in more than 10% mortality of fish populations). However, predictions for the base case show that, even with these schemes, unsustainable mortalities of salmon, the most sensitive species can be expected. Salmon is considered as acting as a surrogate for the more sensitive aspects of ecology, and thus taxa other than salmon may also be harmed under this condition. Further catchment modelling also shows that the frequency, duration and volume of spills from the Earl Pumping Station CSO would continue to rise due to population growth (spill volume and frequency as stated in para. 5.2.2: further details of the projected spills are presented in Section 14 of this volume [Water resources – surface water]). Therefore recovery due to water quality improvements would be suppressed at the Earl Pumping Station CSO discharge site. As a result there are unlikely to be significant changes in habitat quality at the site level and pollution sensitive fish species such as salmon would continue to be suppressed. Indeed, conditions in the immediate vicinity of the outfall may be more unfavourable for fish than the current baseline given the increase in frequency, volume and duration of CSO spills.

5.4.61 The invertebrate analysis demonstrates that more pollution sensitive groups such as shrimps (Gammaridae) are subject to significant fluctuations in abundances during low DO periods. With the improvements associated with the Lee Tunnel scheme and sewage treatment works upgrades at Mogden, these fluctuations are likely to be reduced. Whilst there may be minor changes, increases in abundance and diversity would be limited by the fact that even with the Lee Tunnel and STW improvements in place there are still predicted to be numerous failures of DO standards. Colonisation by DO sensitive taxa such as

Corophiidae, Crangonidae and Gammaridae which would otherwise occur within the brackish zone, including the Earl Pumping Station CSO discharge point, would continue to be suppressed, and may also be less favourable than current baseline conditions because of the increased frequency volume and duration of CSO spills.

5.4.62 The recovery in algal communities that has taken place since the 1960s is expected to continue under the base case; however, the baseline conditions are not anticipated to significantly change from that described in Section 5.4. No changes in marine mammals are anticipated as they are relatively insensitive to point source sewage discharges.

5.4.63 There is unlikely to be any further encroachment onto the tidal Thames foreshore for non-river dependent uses as this is restricted through *London Plan* (Greater London Authority, 2012)[16] Policy 7.28 Restoration of the Blue Ribbon Network which states that development should 'protect the value of the foreshore of the Thames and tidal rivers'. The EA's *National Encroachment Policy for Tidal Rivers and Estuaries (*Environment Agency, 2005)[17] also presumes against developments riverward of the existing flood defences where these would, individually or cumulatively, change flows so that fisheries were affected or cause loss or damage to habitat. Therefore no change to current baseline from other developments is considered likely.

## 5.5 Construction effects assessment

5.5.1 As stated in para. 5.1.2, there would be no construction activities 'in-river' at this site therefore no significant effects on aquatic ecology are likely.

## 5.6 Operational effects assessment

5.6.1 This section presents the findings of the operational phase assessment. It outlines the operational impacts arising from the proposed development and the likely significant effects on aquatic ecology receptors.

### Operational impacts

#### Increases in dissolved oxygen concentrations in the vicinity of the CSO

5.6.2 The projected Typical Year 91% decrease in the volume of discharges compared against the base case (para. 5.2.2) would result in improvements in DO concentrations at a local level and throughout the tidal Thames, and would contribute to a river-wide improvement arising from the project. The Thames Tideway Tunnel improvements would ensure compliance with the DO standards described in para. 5.4.28. The impact is considered to be medium positive due to the existing relatively large number and volume of spills from the Earl Pumping Station CSO, and impacts would be near certain and permanent.

#### Reduction in sediment nutrient levels

5.6.3 Elevated concentrations of nutrients (phosphate and nitrate) are likely to have accumulated in the sediments in proximity to the discharge point as a result of the faecal material and sewage derived litter discharged from the CSO. In addition to the directly toxic effects of elevated ammonia (particularly in low oxygen situations) increased nutrients in the sediment can reduce the natural limits on algal growth and enable more nitrogen/phosphate responsive species to outcompete other species reducing diversity. Interception of the CSO would lead to a gradual reduction in sediment nutrient levels. The impact is considered to be low positive, probable and permanent.

#### Reduced levels of sewage derived litter

5.6.4 Sewage derived litter from the CSO can be expected to reduce by approximately 91%, from approximately 150t to approximately 13t, in the Typical Year with beneficial effects on aquatic ecology receptors.

5.6.5 This is considered to be a low positive impact and would be near certain and permanent.

### Operational effects

5.6.6 The following section describes the effects of these impacts on aquatic ecology receptors based on the significance criteria set out in Vol 2 Section 2.3. Only those impacts which are considered relevant to each receptor are assessed, in accordance with the methodology presented in Vol 2.

5.6.7 Unless stated the effects described below apply to both Year 1 of operation and Year 6 of operation.

#### Designations and habitats

##### Improvements in habitat quality through changes in water quality

5.6.8 The predicted increases in DO concentrations and reductions in organic material and sewage derived litter would result in localised improvements in habitat quality. This may be characterised by increased levels of photosynthesis by microscopic algae within the water column, termed primary production. These algae form the basis of the estuarine food chain, providing a food source for fish and invertebrates. The gradual breakdown and removal by sewage derived litter associated with the sewage discharge would contribute to the recovery. However, habitats per se are relatively insensitive to alterations in DO concentrations, with reductions in sediment nutrient levels and sewage derived litter more important factors with regards to habitat quality improvements. Therefore the impact in this instance is considered to be of low positive magnitude, rather than medium positive. The effects are considered **negligible** at Year 1 increasing to **minor beneficial** by Year 6, given the medium-high (metropolitan) value of the receptor and the low positive magnitude of the impact.

#### Marine mammals

##### Increase in the number and/or change in the distribution of marine mammals

5.6.9 No changes are anticipated on marine mammals as a result of the water quality improvements associated with interception of a single CSO. This is because they are relatively insensitive to point source sewage discharges. Improvements in habitat quality due to the reduction in sewage derived litter may make the habitat more favourable, although the factor determining its use by seals relates predominantly to the lack of disturbance rather than water quality. Effects are considered **negligible**, given the low-medium (local) value of the receptor and the low positive magnitude of the impact.

### Fish

#### Reduction in the occurrence of dissolved oxygen related fish mortalities

5.6.10 Interception of the CSOs throughout the tidal Thames would result in far fewer hypoxia events. The TFRM has been used to predict the change in the number of hypoxia events, and the results are reported in Vol 3. In summary, all tidal Thames fish populations would become sustainable (ie, less than 10% mortality as a result of hypoxia (Turnpenny *et al*, 2004)[18]), compared with the current baseline in which there is a greater than 10% mortality due to hypoxia for four key species (smelt, dace, flounder and common goby).

5.6.11 Interception of the Earl Pumping Station CSO would contribute to tidal Thames-wide improvement, but would also result in improvements in the local area. Given that the impact is considered to be medium positive, and the value of the receptors is medium-high (metropolitan), the effect is thus considered to be **moderate beneficial**.

#### Increase in the distribution of pollution sensitive fish species

5.6.12 The tidal Thames currently supports a small number of rare fish species such as salmon, sea trout, twaite shad and river lamprey (*Lampeta fluviatilis*). A number of factors limit the colonisation of habitats by these species, including salinity, substrate type and current, but pollution is known to be a significant factor in determining colonisation (Maitland and Hatton-Ellis, 2003)[19]. Improving water and sediment quality would facilitate the spread of those pollution sensitive species which are currently being impeded by poor water and sediment quality.

5.6.13 EA data have indicated no records of rare fish species in the vicinity of the Earl Pumping Station discharge site and habitat quality at this site is limited by confinement of the river channel between vertical river walls, which limits the extent of intertidal habitat and leads to increased current velocities. Given that the impact is considered to be medium positive, and the value of the receptors is medium-high (metropolitan), the effect is thus considered to be **negligible** in the short term (Year 1), and **moderate beneficial** in the medium term (Year 6), since it would take time for fish species to colonise.

#### Improvement in the quality of foraging habitat

5.6.14 Intertidal habitat in the upper and middle tidal Thames is used by juvenile fish for foraging. For example, juvenile flounder, bass and smelt migrate to the tidal limit in spring and early summer and then migrate downstream in search of suitable foraging habitat. As habitat quality improves as described in para. 5.6.8, and the invertebrate community becomes more diverse (paras. 5.6.15 to 5.6.20) foraging opportunities for fish may increase. Given that the impact is considered to be medium positive, and the value of the receptors is medium-high (metropolitan), the effect is considered to be **negligible** in the short term (Year 1), increasing to **moderate beneficial** in Year 6 of operation as it would take time for communities to develop.

### Invertebrates

#### Localised improvements in invertebrate diversity and abundance

5.6.15 Improvements in DO concentrations are likely to lead to an increase in the distribution of a range of species that are currently being suppressed by poor water quality conditions. Some of these improvements will occur under the base case due to the Lee Tunnel and sewage treatment works upgrades. However, even with these improvements in place there are still predicted to be a number of occasions during an average year when DO standards would be breached. Colonisation by DO sensitive taxa such as Corophiidae, Crangonidae and Gammaridae which would otherwise occur within the brackish zone would continue to be suppressed.

5.6.16 Full compliance with the standards is expected to enable colonisation by these DO sensitive taxa. In the localised areas around CSO discharges gradual reductions in organic material associated with sewage would also allow for a transition from invertebrate communities dominated by small numbers of species to a more diverse and balanced community. For example, pollution sensitive estuarine taxa such as Corophiidae, Crangonidae, Gammaridae, Sphaeromatidae, Nuculidae, Anthuridae, and Palaemonidae may be expected to increase in abundance.

5.6.17 Improvements in water quality could theoretically selectively enhance colonisation by invasive, non-native species. However, studies on mitten crabs, for example, have determined that the species is able to tolerate poor water quality, but that improvement of water quality does not necessarily lead to an increased distribution (Veilleux and de Lafontaine, 2007)[20].

5.6.18 Given that the impact is considered to be medium positive, and the value of the receptors is medium (borough), the effect is considered to be **negligible** at Year 1 and **minor beneficial** at Year 6 as it would take time for new species to colonise.

#### Increase in the distribution of pollution sensitive invertebrate species

5.6.19 The tidal Thames currently supports a small number of rare invertebrate species, such as swollen spire snail and tentacled lagoon worm. A number of factors limit the colonisation of habitats by these species, including salinity, substrate type and current, but pollution is known to be an important factor in determining colonisation. Improving water and sediment quality would facilitate the spread of those pollution sensitive species which are currently being impeded by poor water and sediment quality.

5.6.20 Survey data for this project have indicated one species of nationally rare (RDB) invertebrate (*A. lacustre*) present in the vicinity of the Earl Pumping Station discharge location, but this is locally very common, and habitat quality at this site is limited by a number of factors including the confinement of the river channel between vertical river walls. Given that the impact is considered to be medium positive, and the value of the receptors is medium (borough), the effect is thus considered to be **negligible** in Year 1, and **minor beneficial** in Year 6, as it would take time for species to colonise.

#### Algae

##### Changes in algal communities

5.6.21 The reduction in nutrient levels, both in the water column and the sediments in the vicinity of the discharge may cause local changes to the algal communities of the river wall. Whilst it is not possible to predict these changes precisely it is likely that the reduction in nutrients would contribute to the recovery of algal flora, with pollution sensitive species becoming a more common component of the community at the expense of more pollution tolerant species.

5.6.22 However, habitat availability would remain a key factor determining the diversity and abundance of algal communities and so the effects associated with the Thames Tideway Tunnel project are considered to be **negligible**, given the low-medium (local) value of the receptor and the magnitude of impact.

#### Sensitivity test for programme delay

5.6.23 For the assessment of effects on aquatic ecology during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above (paras. 5.6.1 to 5.6.22). This is because there are no developments in the site development schedule that would fall into the base case as a result of this delay and therefore the base case would remain as described in paras. 5.4.60 to 5.4.63.

## 5.7 Cumulative effects assessment

5.7.1 As described in Section 5.3, during the operational phase there are no schemes within the site development schedule that would have an impact on aquatic ecology receptors, and so no cumulative impacts with the proposed development would arise. Therefore the effects on aquatic ecology would remain as described in Section 5.6.

#### Sensitivity test for programme delay

5.7.2 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, the cumulative effects assessment would remain unchanged. As described above in para. 5.7.1, there are no schemes anticipated to generate cumulative effects on aquatic ecology and this would remain the case with a programme delay of approximately one year.

## 5.8 Mitigation

5.8.1 No mitigation is required at Earl Pumping Station site since the effects on aquatic ecology receptors are associated only with the improvements in water quality arising from interception of the CSO.

5.8.2 A monitoring programme to measure the recovery of aquatic ecology receptors throughout the tidal Thames following interception of the CSO network will be implemented

## 5.9 Residual effects assessment

### Operational effects

5.9.1 As no mitigation measures are required, the residual operational effects remain as described in Section 5.6. All residual effects are presented in Section 5.10.

## 5.10 Assessment summary

**Vol 22 Table 5.10.1 Aquatic ecology – summary of operational assessment**

| Receptor | Effect | Significance of effect | | Mitigation | Significance of residual effect |
|---|---|---|---|---|---|
| | | Year 1 | Year 6 | | |
| Designations and habitats | Improvements in habitat quality through changes in water quality | Negligible | Minor beneficial | None | Minor beneficial |
| Marine mammals | Increase in the number and/or change in the distribution of marine mammals | Negligible | Negligible | None | Negligible |
| Fish | Reduction in the occurrence of dissolved oxygen related fish mortalities | Moderate beneficial | Moderate beneficial | None | Moderate beneficial |
| | Increase in the distribution of pollution sensitive fish species | Negligible | Moderate beneficial | None | Moderate beneficial |
| | Improvement in the quality of foraging habitat | Negligible | Moderate beneficial | None | Moderate beneficial |
| Invertebrates | Localised improvements in invertebrate diversity and abundance. | Negligible | Minor beneficial | None | Minor beneficial |
| | Increase in the distribution of pollution sensitive invertebrate species. | Negligible | Minor beneficial | None | Minor beneficial |
| Algae | Changes in algal communities | Negligible | Negligible | None | Negligible |

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Thames Tideway Tunnel
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

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## Volume 22: Earl Pumping Station site assessment

### Section 6: Ecology - terrestrial

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

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 6: Ecology – terrestrial

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# 6 Ecology – terrestrial

## 6.1 Introduction

6.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on terrestrial ecology at the Earl Pumping Station site.

6.1.2 The proposed development has the potential to affect terrestrial ecology due to:

a. site and vegetation clearance, and habitat creation

b. construction and site activities.

6.1.3 Operational effects for terrestrial ecology at this site have been scoped out. This is on the basis that lighting would be provided to the staircase and shaft surface for use during maintenance activity only and maintenance works are limited to intermittent visits to site by people and vehicles. No significant operational effects are considered likely and for this reason only construction effects are assessed.

6.1.4 The following are not considered within the assessment:

a. Contaminated runoff and atmospheric pollution would be controlled through the implementation of the *Code of Construction Practice* (*CoCP*)[i].

b. Designated sites relevant to terrestrial ecology. This is because those that lie within 250m of the site are isolated from the site. No likely effects on these sites due to proposed construction works have been identified. However, the baseline includes details of the designated sites within 250m of the site (para. 6.4.1 to 6.4.2).

c. The presence of invasive plants listed on Schedule 9 of the Wildlife and Countryside Act 1981 (WCA 1981) as this would be managed in advance of site clearance as detailed in the *CoCP* Part A (Section 11). However, the baseline includes the results of the invasive plants survey (para. 6.4.3).

6.1.5 The assessment of the likely significant effects of the project on terrestrial ecology has considered the requirements of the *National Policy Statement (NPS) for Waste Water* (Defra, 2012)[1]. In line with these requirements, designations, species and habitats relevant to terrestrial ecology are identified and measures incorporated into the proposed development described. Based on assessment findings, measures to address likely significant adverse effects are identified. Vol 2 Section 6 provides further details on the methodology.

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[i] The *Code of Construction Practice (CoCP)* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

6.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Vol 22 Earl Pumping Station Figures).

## 6.2 Proposed development relevant to terrestrial ecology

6.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to terrestrial ecology are set out below.

### Construction

6.2.2 The following elements of the construction phase have the potential to affect terrestrial ecology receptors:

a. removal of vegetation

b. construction works on site throughout the construction phase that would create noise and vibration, such as the use of construction machinery and vehicles, and the tunnel excavation.

c. artificial lighting of the site in evenings during winter

d. installation of a brown roof on top of the shaft following completion of works.

#### Code of Construction Practice

6.2.3 The *Code of Construction Practice* (*CoCP)* is formed of Part A covering measures to be applied at all sites and Part B covering site specific measures. The *CoCP* sets out the standards, procedures, and measures for managing and reducing construction effects. These measures would be implemented through a site specific *Construction environmental management plan* (*CEMP*), which would encompass an *Ecology and landscape management plan* (*ELMP*). The *ELMP* would include measures to protect and minimise impacts on sensitive ecological receptors such as designated sites, sensitive habitats (eg trees, scrub, watercourses, grassland), and notable species.

##### Part A

6.2.4 The *CoCP* Part A includes the following measures to reduce impacts on terrestrial ecology:

a. consultation with a suitably qualified ecologist in preparing the control measures within the ELMP and CEMP

b. a check of the site in advance of the works to identify any ecological constraints in addition to those discussed in this Environmental Statement (ES)

c. supervision of works by a suitably qualified ecologist

d. protection of trees

e. measures specific to bats such as the control of lighting, noise and vibration, and procedures to follow if a bat roost is present on site

f. measures to prevent harm to nesting birds and birds that are listed on Schedule 1 of the Wildlife and Countryside Act 1981 (WCA, 1981)

g. use of capped and cowled lighting that is directed away from sensitive ecological receptors

h. controls to minimise noise and vibration, including use of noise enclosures, careful plant selection and careful programming of works

i. controls for site drainage to minimise the potential for pollution of watercourses and contamination of sensitive habitats

j. controls to prevent spread of non-native invasive plants, where present.

**Part B**

6.2.5 The *CoCP* Part B (Section 11) states that protection measures would be provided for trees where localised excavation could damage the roots.

### Environmental design measures

6.2.6 A brown roof on top of the shaft has been incorporated into the project design minimise adverse effects and provide biodiversity enhancements.

## 6.3 Assessment methodology

### Engagement

6.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of terrestrial ecology are presented here (Vol 22 Table 6.3.1).

**Vol 22 Table 6.3.1 Terrestrial ecology – stakeholder engagement**

| Organisation | Comment | Response |
|---|---|---|
| London Borough of Lewisham (Scoping response, April 2011) | In terms of ecology, there has been no proper examination of that beyond the site itself, bearing in mind that the residential properties' rear gardens may well contain species such as nesting birds which would be affected by the construction works. | The surrounding area has been considered in this site assessment. |

### Baseline

6.3.2 The baseline methodology follows the methodology described in Vol 2 Section 6. In summary, the following baseline data has been reported in this assessment:

a. desk study

b. a Phase 1 Habitat Survey was undertaken on 24 November 2010

c. an invasive species survey (species listed on Schedule 9 of the Wildlife and Countryside Act 1981) was undertaken on 14 December 2011.

## Construction

6.3.3 The assessment methodology for the construction phase follows that described in Vol 2 Section 6. There are no site specific variations for this site. All likely significant effects throughout the duration of the construction phase are assessed.

6.3.4 The term significance is used within this volume to refer to project significance levels from negligible to major effects (adverse and beneficial). Adverse moderate or major effects are considered to be significant and require mitigation. Negligible and minor effects are not considered significant and therefore do not require mitigation. These significance criteria and their relationship with levels of significance are based on the Institute for Ecology and Environmental Management guidelines (IEEM, 2006)[2] are given in Vol 2 Section 5.

6.3.5 Section 6.5 details the likely significant effects arising from the construction at the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on terrestrial ecology within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment

6.3.6 No effects on habitats are predicted beyond 10m of the site boundary. Therefore, the assessment area comprises the site and adjacent land within 10m of the site boundary.

6.3.7 The assessment considers breeding birds within 100m of the site. This is considered to be a sufficient distance within the context of the urban environment to ensure that any significant effects on species, for example, from disturbance as a result of construction lighting and noise, are assessed.

6.3.8 The following developments are located in close proximity to the proposed development site, and would be partially under construction and partially complete and operational at the start of construction. This has the potential to affect the base case conditions and lead to cumulative impacts on terrestrial ecology:

a. Cannon Wharf Business Centre, which is located adjacent to the south of the site. This development will comprise a mixed use development and landscaping, which includes both roof gardens and green/brown roofs. Blocks B1, B1, B2, B3, B4, C1, C2, C3, G, H, J and Business Centre will all be complete and operational by the start of construction, and Blocks A, B5, C4, D1, D2, D3, E, F and Family Accommodation will be under construction.

b. The Yeoman Street development, which is located 10m east of Earl Pumping Station, would be under construction during the proposed development site's construction phase. This development will comprise a five-storey residential building with associated green space at roof level and ground level.

No change to the base case conditions for terrestrial ecology are considered likely from any other proposed developments listed in Vol 22 Appendix N, due to the isolated location of these developments from the proposed development site, within the urban context.

6.3.9 No cumulative impacts on terrestrial ecology are considered likely from the proposed developments listed in Vol 22 Appendix N that would be under construction during the construction phase, due to the isolated location of these developments from the proposed development site, within the urban context.

6.3.10 The assessment of construction effects considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

### Assumptions and limitations

6.3.11 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 6. Site specific assumptions and limitations are detailed below.

#### Assumptions

6.3.12 It is assumed for the purposes of this assessment that the current use of the Earl Pumping Station site (described in Vol 22 Section 2) will continue as it is at present.

#### Limitations

6.3.13 No site specific limitations have been identified.

## 6.4 Baseline conditions

6.4.1 The following section sets out the baseline conditions for terrestrial ecology receptors within and around the site, including their value. Future baseline conditions (base case) are also described. All figures referred to in this section are contained in Vol 22 Earl Pumping Station Figures.

### Current baseline

#### Designated sites

6.4.2 The following designated sites relevant to terrestrial ecology are within 250m of the site and are shown on Vol 22 Figure 6.4.1 (see separate volume of figures):

a. Rainsborough Avenue Embankments Site of Importance for Nature Conservation (SINC Grade I of Local importance[ii]) lies approximately 70m to the south east of the proposed development site. This site

[ii] SINC (Grade L) = Site of Importance for Nature Conservation (Grade I of local importance)

comprises a series of narrow, former railway embankments, with birch *(Betula* sp.) woodland, scrub and flower-rich acid grassland.

b. Greenland Dock & St. George's Wharf SINC (Grade B[iii]), an area of open water in Rotherhithe, is located approximately 180m north of Earl Pumping Station.

### Habitats

6.4.3 Habitats recorded within the survey area during the Phase 1 Habitat Survey are described in Vol 22 Table 6.4.1 and shown on Vol 22 Figure 6.4.2 (see separate volume of figures). Target notes (TN#) are indicated on this map and are referred to within the text below.

**Vol 22 Table 6.4.1 Terrestrial ecology – Phase 1 Habitat Survey**

| Habitat type / feature of note | Habitat description |
|---|---|
| Hardstanding | A majority of the survey area comprises hardstanding vehicle routes and parking areas. These areas surround the main pumping station building and adjacent industrial units. |
| Buildings | The pumping station is located in the north of the survey area and comprises a single storey brick building with a flat roof.<br>Located to the south and south west of the pumping station are two smaller single storey brick buildings.<br>To the south of the pumping station, the site area is divided into four, each area occupied by a separate company for light industrial purposes. Buildings comprise a mixture of styles including flat-roofed offices and steel-framed industrial units. |
| Scattered trees | Two lines of mature London plane *(Platanus* × *acerifolia*) trees (TN1) are located adjacent to the western site boundary along Croft Street (off-site), one on the east side of the street and one on the west side of the street. |
| Introduced shrub | A small area of butterfly-bush *(Buddleia davidii)* shrub is located centrally to the survey area between the boundary of the pumping station compound and the adjacent industrial buildings. There is also a small area of butterfly-bush shrub on site along the western boundary.<br>There are two areas of the invasive plants species Japanese knotweed *(Fallopia japonica)* within the proposed development site (see para. 6.4.12). |

[iii] SINC (Grade B) = Site of Importance for Nature Conservation (Grade II of Borough importance)

| Habitat type / feature of note | Habitat description |
|---|---|
| Amenity grassland | Small areas of amenity grassland are located around the site, in the north west and west. |

6.4.4 The buildings and hardstanding on site are not considered to have biodiversity value as habitats, and therefore are considered to be of negligible value.

6.4.5 Scattered street trees comprising mature London plane are located adjacent to the site boundary. These trees enrich the local habitat resource, although they are non-native species. Consequently, these trees are of low (site) value.

6.4.6 The introduced shrub on site mainly comprises non-native plant, butterfly-bush, which is considered to be invasive in London. This habitat is considered to provide no important contribution to the local habitat resource due to the species composition and small extent of habitat. Therefore, this habitat is considered to be of negligible ecological value.

6.4.7 The amenity grassland is small in extent, easily recreated and of low ecological value due to the low species diversity and extent. The amenity grassland habitat is considered to be of negligible value.

### Notable species

6.4.8 Survey results are set out in a notable species report, which is included in Vol 22 Appendix D.1. A summary of the results and an assessment of the value of species associated with the site are set out below.

#### Breeding birds

6.4.9 The Phase 1 Habitat Survey identified the area of introduced shrub and the adjacent mature trees to have some potential to support nesting birds. This habitat is limited in extent and it was therefore not considered necessary to undertake breeding bird surveys.

6.4.10 Desk study data of notable species indicated no records specific to the site. House sparrow *(Passer domesticus)* (Red status[iv], London BAP Priority Species) has been recorded within 500m of the site. It is considered unlikely that house sparrow is associated with the site due to the lack of suitable nesting opportunities (house sparrow nest inside buildings) and the limited availability of foraging resources on site.

6.4.11 Limited nesting or foraging opportunities for birds are present on the site. Small numbers of birds may use the scrub, scattered trees and/or buildings for nesting purposes and are likely to comprise species common to the area. The number of nests that the site could support is considered

[iv] The UK's bird species have been sub-divided into three categories of conservation importance by the UK's leading bird conservation organisations - red, amber and green. Red is the highest conservation priority, with species needing urgent action. Amber is the next most critical group, followed by green.

to be low. The bird resource on and adjacent to the site is considered to be of negligible value.

#### Invasive plants

6.4.12 The invasive plant species Japanese knotweed has been recorded in two locations within the site boundary as shown on Vol 22 Figure 6.4.3 (see separate volume of figures). Japanese knotweed is listed in Schedule 9 Part II of the Wildlife and Countryside Act 1981 (as amended). It is illegal to cause this species to spread or grow in the wild. Invasive plants are not considered further within this assessment as the eradication and control of such invasive species would be managed by the measures set out in the *CoCP* Part A (Section 11), as discussed in para. 6.1.4b.

#### Noise, vibration and lighting

6.4.13 As noise, vibration and lighting has the potential to disturb species on and adjacent to the site, baseline conditions are described here.

6.4.14 Current sources of noise and vibration are mainly derived from the activities of the operational pumping station site and adjacent commercial units. Activities include vehicle movement and general operational and maintenance activities (Section 9 Noise and vibration). Baseline noise levels range from 60 to 62dB$L_{Aeq}$ during the day and 56 and 62dB$L_{Aeq}$ during the evening, with noise levels in the evening highest along Croft Street immediately adjacent to the site.

6.4.15 At night, the site is lit by low level lighting. The site is also heavily influenced by light spill from street lights and residential properties. The sensitivity of this site to additional lighting is therefore low.

### Construction base case

6.4.16 Assuming that the management of the site will continue as it is at present, conditions on site at the start of construction would be the same as current baseline conditions.

6.4.17 The Cannon Wharf Business Centre development (section 6.3.8a), would be partially complete and operational at the start of construction on the proposed development site. The baseline conditions are not expected to change significantly as a result of this development. The landscaping features, associated with the development, would be immature at this stage and of low ecological value.

6.4.18 The noise and vibration base case is described in detail in Section 9. The base case for noise is anticipated to be similar to the current baseline.

## 6.5 Construction effects assessment

### Construction impacts

#### Habitat clearance and creation

6.5.1 Site clearance as part of construction works would result in the loss of introduced shrub and amenity grassland vegetation, in addition to hardstanding and buildings; all of which are considered to be of negligible ecological value. The row of scattered mature trees immediately adjacent to the site would be protected by measures within the *CoCP* Part A (Section 11) and Part B.

6.5.2 A brown roof would be installed on the operational shaft structure after completion of construction. This would provide a gain in habitat for invertebrates and foraging birds.

### Movement, noise, vibration and lighting

6.5.3 Noise and vibration (Section 9 of this volume) is likely to be higher than the ambient levels throughout the construction period with most of the works taking place during the day.

6.5.4 An increase in noise and vibration levels at the site could disturb any birds nesting in the mature trees immediately adjacent to the west of the site. The highest increase in noise levels would be during construction of the shaft (a period of 36 months) where noise levels would reach up to 79dB$L_{Aeq}$ on Chiltern Grove and Croft Street.

6.5.5 Given that the site receives spill from lighting adjacent to the site and with measures in place as part of the *CoCP* Part A (Section 4) to limit light spill, it is considered likely that additional light spill from the site onto adjacent habitats and resultant disturbance effects would be minimal.

## Construction effects

### Habitats

6.5.6 The vegetation to be removed on site is of negligible value. Therefore, the significance of the loss of a small extent of introduced shrub is considered to be probable, **negligible** and not significant.

6.5.7 As tree protection measures would be in place, the scattered mature London plane trees immediately adjacent to the site would not be adversely affected by the proposed works. Therefore, the effect on mature trees adjacent to the site is considered to be probable, **negligible** and not significant.

### Species

#### Breeding birds

6.5.8 There would be some displacement of nesting birds of negligible value due to the loss of a small amount of nesting opportunities on site. This effect is considered unlikely to adversely affect breeding bird populations. Suitable nesting habitat is available within the wider area and it is considered that any birds that are displaced would move to these areas. Therefore, that the effect on breeding birds from the loss of a small amount of nesting habitat would be probable, **negligible** and not significant.

6.5.9 Nesting birds are likely to be displaced from trees immediately adjacent to the south of the site, along Croft Street, due to an increase in noise levels during the construction of the shaft. The adjacent trees are likely to support only a small number of nesting birds, due to the limited extent of this habitat. Any displacement of birds due to noise, is not likely to have a detrimental effect on the population status of these birds. Furthermore, during the majority of the construction phase, birds are likely to habituate to changes in noise levels and disturbance from lighting would be minimised through measures in the *CoCP* Part A (Section 4). It is considered unlikely that birds would be disturbed by noise beyond the streets that are immediately adjacent to the site. The effect of disturbance on nesting birds is considered to be probable, **negligible** and not significant.

6.5.10 The proposed brown roof which would be installed on the operational shaft is considered likely to be beneficial for foraging birds. However, this is unlikely to result in a perceptible change in the local breeding bird populations which would use the brown roof for foraging purposes. Therefore, the effect is considered to be probable, **negligible** and not significant.

### Sensitivity test for programme delay

6.5.11 For the assessment of effects on terrestrial ecology during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above (paras. 6.5.1 - 6.5.10). This is because there are no developments in the site development schedule (see Vol 22 Appendix N) that would fall into the base case as a result of this delay and therefore the base case would remain as described in paras. 6.4.16 - 6.4.18.

## 6.6 Operational effects assessment

6.6.1 As stated in para. 6.1.3, operational activities are limited at this site and are not considered likely to lead to significant operational effects.

## 6.7 Cumulative effects assessment

### Construction effects

6.7.1 As described in para. 6.3.8, parts of the Cannon Wharf Business Centre development, in addition to the Yeoman Street development, would be under construction during the construction phase of the Earl Pumping Station site. These works are located adjacent to and approximately 10m east of the proposed development site and are likely to generate noise and vibration and require the use of construction lighting. These works could result in some disturbance to breeding birds using vegetation (for example, street trees, residential gardens), although birds are likely to become habituated to slight increases in noise and vibration levels. As these developments are both located within close proximity to the proposed development site cumulative effects are likely, however, these are not considered to be significant in view of the temporary nature of the effects and the availability of alternative habitat for birds within the area.

### Sensitivity test for programme delay

6.7.2 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, the cumulative effects assessment would remain unchanged. As described above in para. 6.7.1, there are no schemes anticipated to generate cumulative effects on terrestrial ecology and this would remain the case with a programme delay of approximately one year.

## 6.8 Mitigation

6.8.1 All measures embedded in the design and the *CoCP* of relevance to terrestrial ecology are summarised in Section 6.2. As no significant adverse effects have been identified in Section 6.5, no further mitigation measures for construction are required.

## 6.9 Residual effects

### Construction effects

6.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 6.5. All residual effects are presented in Section 6.10.

## 6.10 Assessment summary

**Vol 22 Table 6.10.1 Terrestrial ecology – summary of construction effects assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| **Habitats** | | | | |
| Introduced shrub, buildings and hardstanding | No significant change in habitat on site as the habitats to be removed are considered to be of negligible value. | Negligible | None | Negligible |
| Scattered trees | No change in the scattered mature tree resource as tree protection measures would be in place during construction. | Negligible | None | Negligible |
| **Species** | | | | |
| Breeding birds | No change in populations and assemblages of breeding birds due to loss of a small area of foraging and nesting habitat on site. | Negligible | None | Negligible |
| | No significant changes in breeding bird populations due to displacement caused by noise and lighting during construction. | Negligible | None | Negligible |
| | No perceptible change in breeding bird populations as a result of the provision of the brown roof foraging resource. | Negligible | None | Negligible |

# References

[1] Defra, National Policy Statement for Waste Water (2012). http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf . Accessed November 2012

[2] IEEM. *Guidelines for Ecological Impact Assessment in the United Kingdom* (2006).

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**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 7: Historic environment

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

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 7: Historic environment

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# 7 Historic environment

## 7.1 Introduction

7.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on the historic environment at the Earl Pumping Station site. The historic environment is defined in para 4.10.2 of the National Policy Statement for Waste Water (NPS) as including all aspects of the environment resulting from interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora. For the purposes of this assessment, heritage assets comprise below and above-ground archaeological remains, buildings, structures, monuments and heritage landscapes within and around the site. Effects during construction are assessed with effects on buried assets presented first, followed by above-ground assets.

7.1.2 Based on a review of the noise and vibration assessment (Section 9), it is concluded that there would be no significant noise or vibration effects requiring offsite mitigation to any listed building. Such effects are therefore not considered further in this assessment.

7.1.3 Although it is recognised in the land quality assessment (Section 8) that remediation is likely to be required at this site, this would be confirmed following completion of detailed risk assessments and potentially further site investigation. It does therefore not form part of the assessment; however, any remediation required would be within the area of the below ground construction works and so would not give rise to further effects.

7.1.4 There are no known buried or above-ground heritage assets of high significance in the assessment area, the setting of which would be a consideration, and this has therefore not been assessed.

7.1.5 The operational phase would not involve any activities below-ground aside from maintenance confined within the tunnel infrastructure. Therefore an assessment has not been undertaken of operational effects.

7.1.6 An assessment of effects from ground movement resulting from the Thames Tideway Tunnel itself is covered in Volume 3 Project-wide Effects. No effects are predicted on historic receptors in the vicinity of this site, therefore no assessment of ground movement effects is presented.

7.1.7 The assessment of the historic environment effects of the project has considered the requirements of the NPS. The assessment covers designated and non-designated assets, and a description of the significance of each heritage asset affected by the proposed development. The assessment covers both above and below ground assets. The effect of the proposed development on the significance of heritage assets is clearly detailed in line with the requirements of the NPS. The role of the design process in helping to minimise effects on the historic environment is explained, and where appropriate, mitigation is proposed. Vol 2 Section 7 provides further details on the methodology.

7.1.8 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

## 7.2 Proposed development relevant to the historic environment

7.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to the historic environment are set out below.

### Construction

7.2.2 All below-ground works during construction are relevant to the assessment because they would potentially truncate or entirely remove any archaeological assets within the footprint of the works. These are described below.

7.2.3 Demolition works would require the removal of existing modern structures within the southern part of the site, including a wall, weighbridge, depot buildings and canopy (see Demolition and site clearance plan, separate volume of figures - Section 1).

7.2.4 It is assumed for the purposes of this assessment that construction of the works compound would entail preliminary site stripping. Site fencing would be erected, supported by timber posts in concrete foundations. Office, storage and welfare facilities would be constructed on pad foundations. Site setup would also entail the diversion of existing services and the construction of new service trenches. A crane base would be constructed on a concrete foundation. These works would involve localised excavations up to 1.0–1.5m deep, as assumed for the purposes of this assessment (see Construction phase 1 plan, separate volume of figures - Section 1).

7.2.5 Permanent below-ground works include deep excavations for the construction of a combined sewer overflow (CSO) drop shaft, in the southern part of the site, and for interception and valve chambers, and connection culverts (these structures would be located within the zones shown in the Site works parameter plan, separate volume of figures - Section 1).

7.2.6 Electrical and control equipment would be housed within the existing Earl Pumping Station. Ventilation columns with an assumed foundation depth of approximately 1.5m would be constructed adjacent to the west side of the existing Earl Pumping Station. A third column would be constructed beside the ventilation chamber. A new wall with security fencing would be built to the south of the pumping station (see Site works parameter plan, separate volume of figures - Section 1).

### Code of Construction Practice

7.2.7 Measures incorporated into the *Code of Construction Practice* (*CoCP*) Part A (Section 12) to protect heritage assets include:

a. The requirement for the contractor to prepare a site-specific *Heritage Management Plan* (HMP), indicating how the historic environment is to be protected. This may take form of both physical protection and working practices.

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

c. Advance assessment to inform the types of plant and working methods for use where heritage assets are close to worksites, or attached to structures that form parts of worksites.

d. Where elements to be demolished are attached to listed structures being retained, they will be separated where practicable, prior to demolition, using non-vibratory techniques such as diamond sawing.

e. Procedures under EPP for the emergency repair of damage to listed buildings. Where there is damage that does not require emergency repair, repair will be affected as making good as part of the construction process. Final repairs to significant finishes will be 'like for like'.

f. Security procedures to prevent unauthorised access to heritage assets and archaeological investigations, and damage to or theft from them, including by the use of metal detectors.

g. Procedures in the event of the discovery of human remains.

h. Procedures under the Treasure Act Code of Conduct 1997, to address the discovery of any artefacts defined in the Treasure Act 1996.

7.2.8 The *Code of Construction Practice (CoCP)* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

7.2.9 There are no site-specific measures incorporated in the *CoCP* Part B (Section 12).

7.2.10 All the measures detailed above form part of the development subject to the assessment, and therefore impacts such as strike damage on heritage assets are considered unlikely to occur and are not assessed. However, site specific measures to mitigate effects on buried heritage, which would be detailed in *Site Specific Archaeological Written Scheme of Investigation (SSAWSI)*, in line with the *Overarching Archaeological Written Scheme of Investigation (OAWSI)* (Vol 2 Appendix E.2), would be subject to the findings of field evaluation, and are therefore reported as mitigation as detailed further in para 7.8.5.

# 7.3 Assessment methodology

## Engagement

7.3.1 Vol 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of the historic environment are presented here. Throughout the environmental impact assessment (EIA) there has been regular liaison with English Heritage and other stakeholders. Vol 22 Table 7.3.1 below summarises the comments raised by consultees and how each comment has been addressed.

**Vol 22 Table 7.3.1 Historic environment – consultation response**

| Organisation and date | Comment | Response |
|---|---|---|
| London Borough of Lewisham - scoping opinion<br>(June 2011) | On the advice of EH, mitigation will need to be determined after a fuller assessment of the environmental impacts. | The assessment identifies appropriate mitigation measures. |
| | Request on the advice of EH that the historic environment is scoped in for the operation phase. | No likely significant operational effects have been identified and the operational phase has therefore not been assessed. |
| English Heritage - phase two consultation response<br>(February 2012) | The north-western corner of the site falls within the Protected Landscape Panorama View from Greenwich Park to St. Paul's Cathedral. Therefore, it would be necessary to undertake a visual impact assessment in order to determine appropriate mitigation. | An assessment of townscape and visual effects is presented in Section 11. |

## Baseline

7.3.2 The baseline methodology follows the methodology described in Vol 2. It should be noted that whilst most topics within the ES use the term 'value' to define the sensitivity of environmental receptors within the baseline, the historic environment assessment uses 'asset significance' as per the terminology used within the NPS. Distinction is made between the significance of the resource, i.e. asset significance, and the significance of the environmental effect throughout the following assessment.

7.3.3 Baseline conditions for buried and above-ground heritage assets are described within a 400m-radius area around the centre point of the site, which is considered through professional judgement to be most appropriate to characterise the buried heritage potential of the site. There are occasional references to assets beyond the baseline area, for example, the line of Roman Watling Street, which lies approximately 1.5km to the south of the site; an excavation at Rotherhithe Street, approximately 1.6km to the north of the site; and the medieval settlements at Rotherhithe and Deptford, which contribute to current understanding of the site and its environs in the Roman and medieval periods.

7.3.4 A site visit was carried out in March 2011 to identify heritage assets on or adjacent to the site.

## Construction

7.3.5 The assessment methodology for the construction phase follows that described in Vol 2. There are no site-specific variations for undertaking the construction assessment of this site.

7.3.6 In terms of physical effects on above or buried assets, likely significant effects could arise throughout the construction phase. Effects arising from all stages of the construction period are therefore assessed. The construction assessment area for such effects is defined by the site boundary.

7.3.7 Section 7.5 details the likely significant effects arising from the construction at the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on the historic environment within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

7.3.8 Archaeological remains are a static resource, which have reached equilibrium with their environment and do not change (ie, decay or grow) unless their environment changes as a result of human or natural intervention. Furthermore, none of the schemes listed in the site development schedule (Vol 22 Appendix N) would affect heritage assets within the site. Whilst the baseline within the area beyond the site may change as a result of any archaeological excavation and recording carried out as part of a standard program of mitigation for other developments, such information is unlikely to significantly change the current understanding of the historic environment of the site. Therefore any changes to the surrounding baseline would not affect the assessment and are not detailed further within the construction base case. Therefore the base case for the assessment of construction effects on buried and above-ground heritage assets within the site would be the same as the baseline.

7.3.9 With regard to cumulative effects, three developments within the baseline area meet the criteria for consideration in the assessment on buried heritage assets. These comprise:

a. Cannon Wharf, 35 Evelyn Street, adjacent to the southern side of the site

b. Yeoman Street, 10m to the east

c. Marine Wharf West, Plough Way, 100m to the east.

7.3.10 These proposed developments are close enough to the Thames Tideway Tunnel development to potentially have assets in common, for example prehistoric remains within and beneath the alluvium, and post-medieval industrial activity.

7.3.11 Should the programme for the Thames Tideway Tunnel project be delayed by approximately one year, this would lead to no change in the assessment findings, and is therefore not considered further in the assessment. As described above, whilst the baseline within the baseline area beyond the site may change as a result of any archaeological excavation and recording carried out as part of a standard programme of mitigation for other developments, such information is unlikely to significantly change the current understanding of the historic environment of the site. Therefore a delay to the Thames Tideway Tunnel project, with a consequent change in other schemes which may have been developed by the time of Thames Tideway Tunnel construction, would not lead to any change in the baseline and therefore no change in the assessment of effects on these assets.

## Assumptions and limitations

7.3.12 The assumptions and limitations associated with this assessment are presented in Vol 2. Site-specific assumptions and limitations are detailed below.

### Assumptions

7.3.13 The assessment of effects on buried heritage assets is based on the shaft and other below-ground structures being located anywhere within the limits of deviation identified on the permanent works plan for these structures. For this site the assessment is not sensitive to variations in location within these limits of deviation because the desk-based assessment has not located any buried heritage assets of high significance within the site, which would warrant preservation *in situ*, (see Site works parameter plan, separate volume of figures - Section 1).

7.3.14 A number of assumptions have been made regarding the likely depth of temporary construction works (eg site strip, footings for plant and accommodation), based on professional knowledge of construction projects. Whilst the precise nature of construction effects on buried heritage would vary if the depths varied, the mitigation proposed to address any effects would remain as stated, as would the residual effects. These assumptions are detailed in Section 7.2.

### Limitations

7.3.15 A limitation of the assessment is that no intrusive archaeological investigation has been carried out on the site in the past. Nevertheless the assessment is considered to be robust and in accordance with best practice.

## 7.4 Baseline conditions

7.4.1 The following section sets out the baseline conditions for the historic environment within and around the site. Future baseline conditions (base case), which would remain as per the baseline, are also described. The section comprises sub-sections:

a. a description of historic environment features within the 400m-radius baseline area

b. a description of statutorily designated assets within the site and baseline area. Locally designated assets and known burial grounds are included, where relevant, as described in Volume 2

c. a description of the site location, topography and geology

d. a summary of past archaeological investigation, providing an indication of how well the area is understood archaeologically

e. a chronological summary of the archaeological and historical background of the site and its environs

f. a statement of significance for buried heritage assets, taking account of factors affecting survival

g. a statement of significance for above-ground assets within and around the site, describing the features which contribute to their significance, including historic character, appearance and setting.

### Current baseline

#### Historic environment features

7.4.2 The historic environment features map (Vol 22 Figure 7.4.1, see separate volume of figures) shows the location of known above-ground and buried historic environment features within the baseline area, compiled from the baseline sources set out in the methodology in Vol 2. These have been allocated a unique historic environment assessment reference number (HEA 1, 2, etc), which are listed in the gazetteer in Vol 22 Appendix E.1.

#### Designated assets

##### International and national designations

7.4.3 The baseline area does not contain any nationally or internationally designated (statutorily protected) heritage assets, such as scheduled monuments, or registered parks and gardens. There is one listed building within the baseline area: a Grade II listed capstan at Greenland Dock, approximately 350m to the north of the site.

##### Local authority designations

7.4.4 The site does not lie within a conservation area and contains no locally listed buildings. The site lies entirely within the northern part of an archaeological priority area, which covers Deptford, including The Strand, Sayes Court, and the Royal Naval Dockyard.

### Known burial grounds

7.4.5 There are no known burial grounds within the site or adjacent to it.

### Site location, topography and geology

7.4.6 The site lies 520m west of the River Thames. The Surrey Docks lie 180m to the north and 220m to the east. The ground level of the site and the surrounding area is fairly flat at 101.5–102.0m ATD (above Tunnel Datum). The Earl's Sluice, a long redundant stream that was enclosed as a sewer in the early 19th century, crosses the centre of the site from east to west site. The sluice was originally part of a much greater, older, tributary channel to the Thames originating in Bermondsey. An ancient depression feature in the landscape known as the Bermondsey Lake, the extent of which is unknown, potentially extends as far as the site.

7.4.7 British Geological Survey borehole data indicates that the site is on a highpoint in the undulating underlying gravels, at 97.6m ATD. Areas of high gravel could have formed a focus for prehistoric human activity given their relationship to the river and lake and the resources these provided. Overlying the gravel are variable 'wetland peats to fluvial sands'. The surface of the peats and organic clays were previously encountered from approximately 100.0m ATD and the fluvial deposits from 98.6m ATD. These sand and peat deposits are sealed by alluvium encountered from approximately 98.0 to 100.0m ATD. Within the boundary of the gravel and overlying peat a prehistoric soil may be preserved. Above the alluvium is around 1.0m of made ground, which forms the ground surface. The site topography and geology is discussed in more detail in Vol 22 Appendix E.2.

### Past archaeological investigations

7.4.8 No archaeological investigations have been carried out on the site in the past, although several in the vicinity have revealed palaeoenvironmental evidence, including prehistoric peat and timbers. An evaluation 195m to the west of the site, revealed evidence of *in situ* prehistoric activity. There are also finds of residual (outside the context in which it was original deposited) struck flint. Further details of past archaeological investigations carried out within the baseline area are included in Vol 22 Appendix E.3.

### Archaeological and historical background of the site

7.4.9 The following section presents a chronological summary of the archaeological and historical background of the site. Further detail is included in Vol 22 Appendix E.4.

7.4.10 Previous investigations in the area have revealed palaeoenviromental remains within and beneath the alluvium, indicating that the site and the surrounding area lay within intertidal marshes by the Bronze Age, and was prone to flooding; although, the area lay within a mosaic of wetland environments and scattered areas of dry ground from the early prehistoric (Mesolithic) period (ie, 12,000 years ago). The site itself lies on an area of high gravel and it may thus have attracted prehistoric activity in a landscape that was probably exploited for a number of predictable resources (eg, food, water and reeds). Timber trackways may have provided access across waterlogged areas, as has been recorded in similar environments elsewhere in the Lower Thames Valley. An evaluation (HEA 5), 195m to the southwest of the site, revealed several undated pits, containing evidence of burning, along with five or six struck flints, on the edge of a weathered sand island. Residual undated prehistoric struck flint has been uncovered 100m to the northwest of the site (HEA 4), and struck flint dated to the Palaeolithic period, recovered 215m to the northwest of the site (HEA 14).

7.4.11 Recent previous investigations in the baseline area have not revealed any Roman (AD 43–410) features or evidence of occupation. Rising water levels suggest that the area was prone to flooding and probably lay in open marshland. As such it would not have been suitable for settlement, but was possibly in an area exploited for a number of intertidal/marshland resources. In 1867, the construction of warehouses 80m to the north of the site (HEA 12) revealed an earthenware vase containing 1300 Roman coins 1.5m below the ground. At Chilton Grove (HEA 13), approximately 80m to the west, another coin hoard was discovered in a Roman pot during sewer excavations in 1946.

7.4.12 During the medieval period (AD 410–1485) the site would have been marshland pasture prone to flooding, with settlement located some distance away at Rotherhithe, 1.4km to the northwest of the site, and at Deptford, 2km to the south. Towards the end of the medieval period the marshland was probably drained and reclaimed for pastoral and agricultural use.

7.4.13 During the early post-medieval period (AD 1485–present) the riverside area to the southeast and east of the site was occupied by docks, constructed from the late 17th century. The open fields to the west of the docks, in which the site is situated, became increasingly urbanised in the 19th and early 20th centuries, with a number of industrial and residential buildings. A map from the late 18th century show the east-west Earl's Sluice drain across the middle of the site (Vol 22 Appendix E.5, Vol 22 Plate E.2). This is now contained within a modern sewer pipe. By the mid 19th century, the northern part of the site was occupied by terraced houses and yards fronting onto Chilton Street and backing onto the Earl Sewer, with a tar pitch, naphtha and creosote works in the southeastern corner of the site. This had been demolished by 1909. In the late 1940s the site had been cleared of houses and the existing pumping station (HEA 1) constructed, with two tanks situated immediately to the south of the building. The existing light industrial/office buildings in the southern half of the site were built in the 1950s.

### Statement of significance: buried heritage assets on the site

#### Introduction

7.4.14 The following section discusses past impacts on the site which are likely to have compromised asset survival (generally from late 19th and 20th century developments, eg, building foundations), identified primarily from historic maps, the site walkover survey, and information on the likely depth of deposits.

7.4.15 In accordance with the National Policy Statement for Waste Water (Defra, 2012)[1], National Planning Policy Framework (DCLG, 2012)[2] and PPS5 Planning Practice Guide (DCLG, 2010)[3], (which remains extant), this is followed by a statement on the likely potential for and significance of buried heritage assets within the site, derived from current understanding of the baseline conditions, past impacts, and professional judgement.

**Factors affecting survival**

7.4.16 Archaeological survival potential across the site is generally likely to be moderate, with localised disturbance from building development from the mid/late 19th century onwards. Remains within and beneath the deeper alluvial deposits, and at the alluvial/gravel interface (ie, palaeoenvironmental and prehistoric Roman remains) are likely to be largely intact. Other factors affecting survival include:

a. It is likely that the construction of houses on the edges of the site from the mid-19th century onwards, and industrial buildings in the southeastern corner, will have caused localised ground disturbance, eg, foundations and services to 1.0–1.5mbgl (possibly deeper for pad foundations of the larger buildings) and up to 3mbgl for basements/cellars. This will have truncated locally any remains at the top of the alluvium and within the overlying made ground (eg, any later medieval and post-medieval remains), although deeper (and earlier) assets potentially survive intact.

b. The construction of the Earl Pumping Station sewage works and associated pumps and tanks will have necessitated localised excavation for service trenches and foundations. Current services within the site include a number of drains and cables running throughout the northern part of the site. These are fairly shallow at up to 1.5m deep, but two combined sewers are located at a depth of approximately 5.3mbgl. The latter will have removed all archaeological remains locally. The southern area of the site contains fewer services, all of which are located at the eastern and western ends of the site, excepting two foul water drainage pipes, lying at a depth of 3.1mbgl, running east-west and north-south.

c. The made ground/archaeological deposit sequence is likely to be approximately 4.5m deep below modern ground level. The combined effect of the 19th/20th century building development described above is likely to have significantly reduced archaeological survival and hence asset significance, although localised remains at deeper (earlier) levels are likely to be present.

d. There is likely to be considerable ground contamination within the footprints of the Earl Pumping Station site. The depths and extent of contamination across the site are reported in section 8 (land quality) and section 13 (groundwater), this may have led to physical, chemical or biological decay of archaeological remains. The impacts of contamination will be specific to particular classes of archaeological remains, however, and impacts as a whole may be favourable as well as detrimental to certain classes of remains, depending on the types of ground contaminants present.

### Asset potential and significance

7.4.17 The following statement of asset significance takes into account the levels of natural geology and the level and nature of later disturbance and truncation.

*Palaeoenvironmental*

7.4.18 The site has a high potential to contain palaeoenvironmental remains. The site is situated on the Thames floodplain, on alluvium, overlying river terrace gravels. Borehole results from within the site have revealed deposits of peaty clay and clay and wood which have a high potential to preserve palaeoenvironmental remains. Previous investigations within the baseline area have also uncovered organic layers preserving remains such as prehistoric timbers. Such remains would be of low or medium significance depending on their nature and degree of preservation. This would be derived from the evidential value of such remains.

*Prehistoric*

7.4.19 The site has an uncertain, probably moderate, potential overall to contain prehistoric remains. Although scattered remains dating to the prehistoric period have been discovered within the baseline area, it is uncertain whether these are evidence of activity or residual finds (ie outside the context in which they were originally deposited). Available geological information suggests the site lay on higher ground within wet marshland prior to the Bronze Age and may have been the focus for activity and settlement. The remains of timber trackways, used to traverse the marshes and boats, may potentially be preserved within such environments. Redeposited finds (moderate probability) would be of low significance. Localised settlement evidence (moderate probability) would be of medium or high significance, *in situ* timber structures (low probability) would potentially be of high significance.

*Roman*

7.4.20 The site has an uncertain, probably low, potential to contain Roman remains. Although two Roman coin hoards have been discovered within the baseline area, no other finds or features dating to this period are known. It is possible that the site remained wet marshland in this period. The coin hoards suggest there were dry and habitable areas, but not in the immediate vicinity of the site. Isolated artefacts and features would be of low or medium significance, depending on the nature and extent, eg, if remains indicating industrial activities on the marshes were present.

*Early medieval*

7.4.21 The site has a low potential to contain early medieval remains. There are no known finds or features dated to this period within the site or baseline area. Previous investigations have revealed evidence of rising water levels in this period which probably rendered the area of the site uninhabitable, but may have provided ideal pasture land. Isolated rural landscape features such as field drainage ditches would be of low significance.

*Later medieval*

7.4.22 The site has a low potential to contain later medieval remains. There are no finds or features dated to this period within the site or baseline area. It is likely that the open marshland began to be reclaimed in this period, perhaps for pasture or agriculture. Pre-18th century maps show the site as lying in an area of open fields and it is unlikely that later medieval remains would be found on the site. Evidence of reclamation and drainage ditches would be of low significance. This would be derived from the evidential and historical value.

*Post-medieval*

7.4.23 The site has a high potential to contain post-medieval remains. The site and its immediate vicinity began to be developed into a mixed industrial and residential area from the mid-19th century onwards. It is possible that the footings of Victorian terraced houses and factory buildings may survive on the site. Such remains, if present, would be of low significance. This would be derived from the evidential and historical value.

### Statement of significance: above-ground heritage assets

#### Introduction

7.4.24 In accordance with the *National Policy Statement for Waste Water* and the associated guidance, the following section provides a statement of the likely significance of heritage assets based on professional and expert judgement. The significance of assets is a reflection of their value or importance, derived from their perceived historical, evidential, aesthetic and communal value. These terms are defined in Vol 2.

#### Within the site

7.4.25 The Art Deco style Earl Pumping Station (HEA 1) is typical in municipal design and layout of its day. It is in good condition. It is likely that the building was designed and planned in the late 1930s but was delayed by the outbreak of World War II, with construction commencing in the late 1940s. There are ancillary structures such as a weighbridge and canopy. The building is of low asset significance, derived from its evidential and historical value.

#### Within the baseline area

7.4.26 Yeoman Street is cobbled (HEA 20) with patches of macadam repair and is probably related to earlier phases of industrial buildings located within the area, dating from the 19th and 20th centuries. It is of low asset significance, derived from its evidential and historical value.

7.4.27 A terrace of two-storey houses (HEA 21), dating to approximately the middle of the 19th century, is located approximately 60m from the southwest corner of the Earl Pumping Station. The houses are heritage assets of low significance, as derived from their evidential and historical value.

7.4.28 There would be no physical effects on these assets as a result of the proposed development. Measures incorporated into the *CoCP* Part A

(Section 12) would protect against accidental strike damage. These assets are therefore not considered further in this assessment.

### Construction base case

7.4.29 As described in para. 7.3.8, no developments identified within the site development schedule would lead to any loss of or change in the buried of above-ground heritage assets within the site. The base case for assessing construction effects within the site would therefore be the same as the baseline.

## 7.5 Construction effects assessment

### Buried heritage assets

7.5.1 Effects of construction works are described in the following section in the sequence in which they would occur, with the individual impacts from each phase described. The effects on heritage assets are summarised in Section 7.10, by chronological period.

#### Demolition, site setup and construction of ventilation structures

7.5.2 Works carried out as part of the initial site setup would potentially truncate archaeological remains. They include the temporary diversion or replacement of existing service trenches within the site; the demolition of the existing modern depot buildings, canopy and below-ground weighbridge in the southern part of the site; the construction of the works compound, entailing site stripping; and the erection of site fencing.

7.5.3 The construction of ventilation columns adjacent to the Earl Pumping Station building would involve ground disturbance for shallow foundations, assumed to reach a maximum depth of approximately 1.5m, as assumed for the purposes of this assessment.

7.5.4 Given their localised nature, these works would comprise a low level of impact on any surviving late 19th century terraced housing and industrial building remains of low asset significance, resulting in a **minor adverse** effect. The works might also truncate earlier, medieval, remains of low asset significance, depending on the depth of individual works, resulting in a **minor adverse** effect.

#### Construction of the CSO drop shaft and other permanent below-ground structures and foul sewer diversion

7.5.5 Very deep ground disturbance for the CSO drop shaft, Greenwich connection tunnel and interception chamber would entirely remove any archaeological remains present from within the footprint of each construction. Excavations for the construction of the valve chamber, connection culverts, and the temporary diversion of the foul sewer would be deep enough to heavily truncate, and possibly entirely remove, any archaeological remains present. These works would constitute a high magnitude of impact for any assets, reducing asset significance to negligible. The environmental effect would vary depending on the significance of the assets removed, as detailed below:

a. The site has a high potential for palaeoenvironmental remains, of low or medium asset significance. These remains are throughout the alluvium, which is extensive. As only localised removal is proposed, the overall magnitude of impact would be low (as a resource, the overall asset significance would be little reduced), and would comprise a **minor adverse** effect.

b. The site has an uncertain, probably moderate potential overall for prehistoric remains. Certain types of prehistoric remains are more likely to be present than others:

   i There is an uncertain, probably moderate potential for redeposited prehistoric artefacts, which are likely to be of low asset significance if present. Removal of such remains would constitute a **minor adverse** effect.

   ii There is an uncertain, probably moderate potential for localised prehistoric activity and settlement remains, which are likely to be of medium or high asset significance, if present. Removal of such remains would constitute a **major adverse** effect.

   iii There is a low potential for prehistoric trackways, which would be of high asset significance, if present. The removal of such remains would constitute a **major adverse** effect.

c. There is an uncertain, probably low potential for redeposited Roman remains of low asset significance. The removal of such remains would constitute a **minor adverse** effect.

d. There is a low potential for early/later medieval land reclamation/drainage ditches of low asset significance. The removal of such remains would constitute a **minor adverse** effect.

e. There is a high potential for post-medieval industrial and domestic remains of low asset significance. The removal of such remains would constitute a **minor adverse** effect.

### Above-ground heritage assets

7.5.6 No significant changes are proposed to the Earl Pumping Station. Below-ground structures would be located in the western part of the site, possibly within the Earl Pumping Station. This would constitute a negligible magnitude of impact to the Earl Pumping Station (which is of low heritage significance) as a whole, thus resulting in a **negligible** effect.

## 7.6 Operational effects assessment

7.6.1 As detailed in Section 7.1, operational effects on the historic environment have not been assessed for the Earl Pumping Station site.

## 7.7 Cumulative effects assessment

7.7.1 As detailed in para 7.3.9 and 7.3.10, three proposed developments in the baseline area have the potential to have an impact upon buried heritage assets that are common to the Thames Tideway Tunnel site, such as prehistoric landsurfaces or evidence activity within and beneath the alluvium, and buried post-medieval industrial remains. This could lead to an elevated effect on such assets. However, provided that an adequate mitigation strategy of preservation by record is implemented at these other developments, this would be sufficient to reduce residual effects to negligible.

## 7.8 Mitigation

7.8.1 As per the NPS, (para 4.10.19), a documentary record of a heritage asset is not as valuable as retaining the heritage asset, and it should not be a factor in the decision as to whether or not development consent is given. Nevertheless, it is the most appropriate form of mitigation available and in EIA terms serves to reduce the significance of the adverse effect, as has been agreed with English Heritage.

### Buried heritage assets

7.8.2 Based on this assessment, no heritage assets of high significance are anticipated that would merit a mitigation strategy of permanent preservation *in situ*. It is therefore considered that the minor to major environmental effects of the proposed development on buried heritage assets within the site during the construction phase could be successfully mitigated by a suitable programme of archaeological investigation before and/or during construction, to achieve preservation by record through advancing understanding of asset significance.

7.8.3 Mitigation requirements would be informed by selective site-based assessment. This could include a variety of techniques, such as geotechnical investigation, geoarchaeological deposit modelling, archaeological test pits and trial trenches. This evaluation would enable a more targeted and precise mitigation strategy to be developed for the site in advance of construction. Both evaluation and mitigation would be carried out in accordance with a scope of works (*Site Specific Archaeological Written Scheme of Investigation [SSAWSI])*, as detailed in para 7.8.5 below.

7.8.4 Subject to the findings of any subsequent field evaluation and the detailed construction methodology employed by the contractor, mitigation of the adverse effects upon archaeological remains within the site would include the following as appropriate:

a. An archaeological watching brief during demolition of buildings, service diversions and other ground disturbance as part of initial site setup, and during construction, to mitigate impacts upon 19th century remains of low asset significance.

b. Combination of watching brief and targeted archaeological investigation of deep construction works (eg shaft, chambers etc) accompanied by palaeoenvironmental sampling. Due to the depth of alluvium on the site, targeted archaeological investigation of palaeoenvironmental and prehistoric remains would only become feasible following the insertion of the perimeter walls/shaft segments of each construction. Targeted investigation would proceed as the ground within the perimeter walls/shaft segments is excavated downwards.

7.8.5 Both evaluation and mitigation would be carried out in accordance with a scope of works (*Site Specific Archaeological Written Scheme of Investigation [SSAWSI]*), based on the principles in the *Overarching Archaeological Written Scheme of Investigation (OAWSI)*, to ensure that the scope and method of fieldwork are appropriate. The *SSAWSI* would be submitted in accordance with the application for development consent (the 'application') requirement.

### Above-ground heritage assets

7.8.6 In terms of above-ground heritage assets, as no adverse effects have been identified, no mitigation is required.

## 7.9 Residual effects assessment

### Construction effects

### Buried heritage assets

7.9.1 With the mitigation described above in place, the residual construction effects on buried heritage assets would be **negligible**. All residual effects are presented in Section 7.10.

### Above-ground heritage assets

7.9.2 As no mitigation measures are proposed, the residual effects remain as described in Section 7.5. All residual effects are presented in Section 7.10.

## 7.10 Assessment summary

**Vol 22 Table 7.10.1 Historic environment – summary of construction assessment**

| Asset (receptor) | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| **Buried heritage assets** | | | | |
| High potential for palaeoenvironmental remains (Low or medium asset significance) | Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures and foul sewer diversion Asset significance reduced to negligible. | Minor adverse | Targeted archaeological investigation and recording, including environmental sampling. | Negligible |
| Uncertain, probably moderate potential for redeposited artefacts of prehistoric date (Low asset significance) | Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures and foul sewer diversion Asset significance reduced to negligible. | Minor adverse | Targeted archaeological investigation and recording. | Negligible |
| Uncertain, probably moderate potential for evidence of localised prehistoric activity or settlement (Medium or high asset significance) | Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures and foul sewer diversion Asset significance reduced to negligible. | Major adverse | Targeted archaeological investigation and recording. | Negligible |
| Low potential for prehistoric timber trackways (High asset | Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures and foul sewer diversion Asset significance reduced to negligible. | Major adverse | Targeted archaeological investigation and recording. | Negligible |

| Asset (receptor) | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| significance) | | | | |
| Uncertain, probably low potential for redeposited Roman artefacts<br>(Low asset significance) | Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures and foul sewer diversion<br>Asset significance reduced to negligible. | Minor adverse | Targeted archaeological investigation and recording. | Negligible |
| Low potential for evidence of early/ later medieval land reclamation/drainage ditches<br>(Low asset significance) | Assets removed by demolition, site setup and the construction of ventilation structures.<br>Asset significance reduced to negligible. | Minor adverse | Archaeological watching brief. | Negligible |
| | Assets would be removed by excavation for the CSO drop shaft, and other permanent below-ground structures and foul sewer diversion<br>Asset significance reduced to negligible. | Minor adverse | Targeted archaeological investigation and recording. | Negligible |
| High potential for buried 19th century remains, including the footings of previous houses and factory buildings and associated yards on the site<br>(Low asset significance) | Assets removed by demolition, site setup and the construction of ventilation structures.<br>Asset significance reduced to negligible. | Minor adverse | Archaeological watching brief. | Negligible |
| | Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures and foul sewer diversion<br>Asset significance reduced to negligible. | Minor adverse | Archaeological watching brief. | Negligible |
| **Above-ground heritage assets** | | | | |
| Earl Pumping Station<br>(Low asset significance) | Inclusion of below-ground structures within the pumping station building. Demolition of ancillary elements. | Negligible | None | Negligible |

# References

[1] Department of Environment, Food and Rural Affairs. *National Policy Statement for Waste Water (*2012)

[2] Communities and Local Government*. National Planning Policy Framework* (March 2012)

[3] Department of Communities and Local Government, English Heritage & Department for Culture, Media and Sport*. PPS5 Planning for the Historic Environment: Historic Environment Planning Practice Guide* (March 2010)

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**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 8: Land quality

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

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January 2013

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 8: Land quality

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# 8 Land quality

## 8.1 Introduction

8.1.1 This section presents the findings of the assessment of the likely significant land quality effects of the proposed development at the Earl Pumping Station site.

8.1.2 The scope of the land quality assessment is to:

a. describe the condition of the site in terms of contaminant history and likely presence and magnitude of soil/sediment and liquid contamination (such as groundwater or perched water within the Made Ground), in addition to unexploded ordnance (UXO) and the presence of Japanese Knotweed, an invasive plant species which can be regarded as a soil contaminant.

b. describe and assess the impacts and significant effects of the interaction between these contaminants and the built environment, human and environmental receptors as a result of construction of the proposed development (taking into account any embedded measures).

8.1.3 There are a number of interfaces between land quality and other topic sections, as summarised below:

a. Section 13 Water resources – groundwater assesses the likely significant effects to water resources from soil, perched water and groundwater contamination. The land quality assessment considers potential risks to human health receptors (eg, construction workers) from contaminated perched water and groundwater, including free phase[1] contamination

b. Section 4 Air quality and odour assesses the likely significant effects to the air quality during the construction and operation of the site. The land quality assessment considers potential risks from, for example, the generation of dust and soil vapour from exposed ground and soils during construction

8.1.4 Operational land quality effects for this site have not been assessed. This is on the basis of the embedded measures adopted during the construction and operational phases (refer to Section 8.2 and Vol 2 Section 8.6). No significant operational effects are considered likely and for this reason only information relating to construction is presented in the assessment of effects on land quality.

8.1.5 The assessment of the likely significant effects of the project on land quality has considered the requirements of the National Policy Statement

[1] Free phase contamination – hydrocarbons that form a discrete layer within groundwater, either floating on the groundwater surface or at the base of a groundwater body.

for Waste Water (Defra, 2012)[1] section 4.8. The risk posed by construction on previously developed land is addressed in the following assessment and through measures embedded in the *Code of Construction Practice* (*CoCP*) (further details can be found in Vol 2 Section 8.3). The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B)

8.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

## 8.2 Proposed development relevant to land quality

8.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to land quality are set out below.

### Construction

8.2.2 The elements of the proposed development relevant to land quality would consist of the following:

a. demolition of existing structures, such as industrial buildings and weighbridge

b. construction of pits, chambers, ducts and pipes for cables, pipes, utility connections and diversions and drainage

c. combined sewer overflow (CSO) drop shaft extending to the underlying Chalk at an invert level of approximately 51m below ground level (bgl)

d. an interception chamber for the existing CSO overflow extending approximately 12m bgl

e. a connection culvert to the drop shaft

f. construction of an interception chamber, overflow structure and other hydraulic structures

g. construction of air management plant and equipment including filters and ventilation columns, ducts and chambers.

8.2.3 The base of the CSO drop shaft is anticipated to be located within the Chalk and internal dewatering within the proposed diaphragm walls would be required within the lower aquifer (ie, Thanet Sand and Chalk formations).

8.2.4 The above works would involve extensive below ground construction, resulting in the excavation and removal of material, including Made Ground and natural soils below.

8.2.5 An area would also be required within the site for construction logistics, such as materials handling and storage areas, site welfare facilities and offices (as shown in Earl Pumping Station site construction plans - see separate volume of figures).

### Code of Construction Practice

8.2.6 The embedded design measures relevant to land quality at the site are set out in Section 9 of the *CoCP* and are summarised below. Reference should be made to the *CoCP* Part A for full details.

8.2.7 There are no site specific *CoCP* measures which are relevant to this land quality assessment.

8.2.8 Land quality issues would be managed in close liaison with the local authority, London Borough (LB) of Lewisham, and the Environment Agency (EA) prior to and during construction.

#### Pre-construction

8.2.9 The proposed development has been characterised and assessed with respect to land quality through the application of the following steps (which are dictated by the regulatory framework outlined in Section 9 of the *CoCP*):

a. completion of a desk study which would include a review of available information sources (see Vol 22 Appendix F.1) and production of an initial conceptual site model

b. undertaking of specialist site surveys, such as Japanese Knotweed and desk study for UXO risk, which to date has included a site-specific desk study for part of the Earl Pumping Station site to inform ground investigation work (see Vol 22 Appendix F.2)

c. completion of intrusive site investigation and preparation of a preliminary risk assessment, detailed quantitative risk assessment and remediation options appraisal.

8.2.10 In addition to the above, land quality will continue to be assessed via additional ground investigations as the project develops to confirm findings and extend investigations into areas where access is currently restricted. Results of any additional site-specific land quality risk assessment would be used to refine the existing remediation options appraisal and a site-specific remediation strategy would be produced and implemented, following agreement with the regulators (EA and LB Lewisham) including:

a. details of the remediation strategy and methodology

b. methodology for decommissioning and removal of structures, such as underground storage tanks, if and where encountered

c. details of validation requirements to document the successful clean-up works.

#### Construction

8.2.11 Health and safety measures for the protection of construction workers with respect to land quality issues would include:

a. the provision of adequate training for all construction site workers to recognise and appropriately respond to potential land quality issues

b. site welfare facilities and where appropriate, decontamination units (ie, dirty in, clean out welfare units)

c. use of standard construction site personal protective equipment (PPE) (eg, high visibility clothing, safety boots, hard hat, safety glasses gloves and respiratory equipment)

d. robust emergency procedures (eg, with respect to UXO, previously unidentified contamination or structures), which are periodically reviewed. In the event of previously unidentified conditions being encountered, works would be suspended, the work area evacuated and specialist advice obtained. Where appropriate, risk assessments would be undertaken and additional control measures implemented prior to any works recommencing.

8.2.12 During construction, effective material management procedures, such as the storage and handling of excavated soils, fuels and other chemicals (as detailed further in the surface water section of the *CoCP*), would be implemented. Excavated materials with the potential to be contaminated would be removed from site as soon as practicable. Site control measures would be implemented to reduce dust (see air quality section of the *CoCP*) and the spread of mud by vehicles (see public access, the highway and river transport section of the *CoCP*).

8.2.13 Environmental monitoring, would include the following measures:

a. on-site watching brief during potentially high risk activities and an on call watching brief for all other activities. Specialist watching brief may include: UXO; contaminated land; health and safety/occupational health; and ecological (for invasive species, such as Japanese Knotweed)

b. dust and air/vapour monitoring (see *CoCP* Section 9 for further details). Where appropriate, this would include a combination of on-site and boundary monitoring.

## 8.3 Assessment methodology

### Engagement

8.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of land quality are presented here.

8.3.2 Both the LB of Lewisham and LB of Southwark were specifically consulted with respect to any land quality data they hold at the site and surrounding area. A review of this data is presented in Vol 22 Appendix F.1.

### Baseline

8.3.3 The baseline methodology follows the methodology described in Vol 2. There are no site-specific variations for identifying the baseline conditions for this site.

## Construction

8.3.4 The assessment methodology for the construction phase follows that described in Vol 2. There are no site-specific variations for undertaking the construction assessment of this site.

8.3.5 The construction assessment area considered for the assessment of land quality includes the limits of land to be acquired or used (LLAU) plus an additional 250m buffer area. This assessment area has been selected in order to take account of any off-site sources that could impact on the land quality of the site as well as any nearby sensitive receptors.

8.3.6 The construction assessment has been undertaken for Site Year 1 of the construction phase.

8.3.7 The base case and cumulative assessment in Site Year 1 of construction take into account the schemes described in Vol 22 Appendix N. The baseline is unlikely to change substantially between the base case year and Site Year 1 of construction (2017). There are two proposed developments within the 250m buffer (as shown in Vol 22 Table 8.3.1) which are likely to be complete and operational before the commencement of the construction phase and as a result form part of the construction base case.

8.3.8 The developments within the 250m buffer area which are not considered as part of the construction base case are those developed during and after Site Year 1 of construction, these are included within the cumulative effect assessment and are also identified in Vol 22 Table 8.3.1.

**Vol 22 Table 8.3.1 Land quality – construction base case and cumulative assessment development (2017)**

| Development | Distance from site | Construction base case | Cumulative impact assessment |
|---|---|---|---|
| Cannon Wharf, 35 Evelyn Street,(demolition of existing buildings and construction of commercial/residential properties – blocks B1, B2, B3, B4, C1, C2, C3, G,H, J and business centre) | Adjacent | ✓ | ✗ |
| Tavern Quay, Rope Street, (construction of mixed use development including business and residential use) | 150m northeast | ✓ | ✗ |
| Yeoman Street (construction of residential property) | 10m east | ✗ | ✓ |
| Marine Wharf West, Plough | 100m | ✗ | ✓ |

| Development | Distance from site | Construction base case | Cumulative impact assessment |
|---|---|---|---|
| Way (construction of mixed use development including commercial and residential use and public open space | east | | |
| Cannon Wharf, 35 Evelyn Street (demolition of existing buildings and construction of commercial/residential properties – blocks A, B5, C4, D1, D2, D3, E, F and family accommodation) | Adjacent | ✗ | ✓ |

*Symbols ✓ applies ✗ does not apply*

8.3.9 Section 8.5 details the likely significant effects arising from the construction at the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on land quality within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

### Development of conceptual model

8.3.10 The assessment of land quality effects is based on the development of a source-pathway-receptor (SPR) conceptual model. This model aims to understand the presence and significance of potentially complete pollutant linkages.

8.3.11 The SPR conceptual model is based on guidance given in *CLR11: Model procedures for the management of land contamination* (EA, 2004)[2]. This type of assessment specifically relates to risk assessment and management of land contamination and has been used to inform the environmental impact assessment (EIA) which seeks to identify the likely significant effects of the proposed development.

8.3.12 The impact assessment considers the anticipated level of contamination likely during Site Year 1 of construction using the categories of receptor sensitivity and impact magnitude described in Vol 2 Section 8.4 and Vol 2 Section 8.5 respectively.

8.3.13 The significance of effects has been determined using the generic matrix given in Vol 2 Section 3.7. A description of the significance criteria is presented in Vol 2 Section 8.5.

8.3.14 The methodology for undertaking both source-pathway-receptor analysis and the impact assessment is provided in Vol 2 Section 8.

### Assumptions and limitations

8.3.15 The assumptions and limitations associated with this assessment are presented in Vol 2. Assumptions and limitations specific to the site are detailed below.

#### Assumptions

8.3.16 The exact approach to remediation cannot be defined at this stage although a remediation options appraisal has been prepared. It is therefore assumed that some contamination would still remain at the time construction commences (either because no pre-commencement remediation is deemed necessary or that following remediation of the construction area some contamination remains on the wider site).

#### Limitations

8.3.17 No site-specific limitations have been identified at the Earl PS site.

## 8.4 Baseline conditions

8.4.1 The following section sets out the baseline conditions for land quality within and around the site. Future baseline conditions (base case) are also described.

### Current baseline

#### Introduction

8.4.2 A full list of the data sets drawn upon in this assessment is presented in Vol 2.

8.4.3 A baseline report is presented in Vol 22 Appendix F.1 which details the data obtained for this site and identifies the main contamination sources that may have affected the site. In addition to Vol 22 Appendix F, this section should also be read in conjunction with Vol 22 Figure F.1.1, Vol 22 Figure F.1.2 and Vol 22 Figure F.1.3 (see separate volume of figures).

#### Summary of baseline conditions

##### Geology

8.4.4 The site is underlain by a cover of Made Ground extending to 2.9m. This underlain by River Terrace Deposits, Lambeth Group (Upnor Formation), Thanet Sand Formation and Chalk Group (see Vol 22 Appendix F.1, Vol 22 Table F.3 for the full geological succession).

##### Contamination

8.4.5 The site has been subject to a number of potentially contaminative historical land-uses including a tar, asphalt and naphtha works as well as the existing use as a sewage pumping station.

8.4.6 The surrounding area immediately to the south, east and west has previously supported potentially contaminative land-uses including tar works, whiting works and timber yards.

8.4.7 Intrusive site investigation data indicates that the underlying River Terrace Deposits and Thanet Sand Formation have been impacted with polycyclic aromatic hydrocarbons (PAHs). Available data shows the principal PAH compound present beneath the site to comprise naphthalene.

8.4.8 The highest concentrations of contaminants were found below 12m bgl in the northwestern part of the site where up to 11800mg/kg of naphthalene (and a total PAH of 41490mg/kg) was recorded at 17m bgl. The identified contamination generally extended to the base of the Thanet Sand Formation at approximately 19m bgl. Migration into the Chalk appears to have been retarded by the silty and locally clayey nature of the basal Thanet Formation.

8.4.9 There is also a local less severe area of contamination at a shallow depth on the northwestern boundary. At this location a maximum naphthalene concentration of 580mg/kg (and a total PAH of 1995mg/kg) was recorded at 4m bgl.

8.4.10 Groundwater beneath the site has also been found to have been impacted with hydrocarbons (both dissolved and free phase).

8.4.11 Additional contaminants associated with the historical land-uses and those found by intrusive investigations include: total petroleum hydrocarbons (TPH); volatile organic compounds (VOCs); phenols and BTEX (Benzene, toluene, ethylbenzene, and xylene).

8.4.12 These contaminants have been recorded to be present in soil, soil vapour and groundwater (including perched water) and maybe hazardous to human health (eg, as irritants or carcinogens or by their volatile or flammable properties) depending on the potential concentration of the substance.

8.4.13 The contamination recorded is above generic soil screening values for human health and some remedial action is possible in order to mitigate risks during both construction and in the final completed scheme. The current options include in-situ chemical oxidation of contamination at the locations of deep excavations to reduce the impacts of soil vapour migration to off-site receptors as soils are excavated and a cover system to provide a barrier between the contamination and end users (which would simply comprise the proposed hardstanding).

### UXO

8.4.14 A desk based assessment for UXO threat was undertaken for ground investigation works at the proposed development site. The report reviews information sources such as the Ministry of Defence, Public Records Office and the Port of London Authority. The report is presented in Vol 22 Appendix F.2.

8.4.15 The report establishes that there were numerous Luftwaffe targets in the area and that nearby areas suffered bomb damage during the 1940 to 1941 bombing campaign which included a v2 rocket strike within 50m of the site.

8.4.16 However, subsequent redevelopment works have taken place on the site and as such the report considered that there is an overall low/medium threat from UXO at the site.

### Summary of receptors

8.4.17 The receptors identified at this site by the baseline survey (see Vol 22 Appendix F.1) and their corresponding sensitivity following the criteria set out in Vol 2 are as follows:

a. construction workers: low sensitivity for general above ground site workers, such as staff in site offices or delivery drivers and high sensitivity for those site workers involved in below ground excavation works and associated activities

b. adjacent land-users: residents (high sensitivity) and workers in the adjacent industrial or commercial land (low sensitivity)

c. built environment: Earl Pumping Station building and associated on-site infrastructure and off-site residential and commercial buildings (all low sensitivity).

### Construction base case

8.4.18 For land quality, the assessment of construction effects is based on the conditions which are likely to be experienced in Site Year 1 of construction (base case).

## 8.5 Construction effects assessment

### Construction assessment case

8.5.1 The embedded requirement for a risk assessment and potential remediation of land contamination that forms part of the proposed development (refer to the *CoCP* Section 9 and summary presented in Section 8.2) mean that the land quality of the site may be different to that described in 8.4.

8.5.2 Where deemed necessary, problematic or gross contamination, which may substantially hinder the construction programme or which cannot be adequately dealt with in a controlled manner during construction, would be remediated prior to the commencement of the main construction works (such as the CSO drop shaft excavation and in other areas of proposed excavation, where necessary). For instance this could potentially include chemical oxidation of the known hydrocarbon plume at the shaft location following installation of the diaphragm wall but prior to main shaft excavation. This action would significantly reduce risks from vapour migration during excavation.

8.5.3 However since the exact approach to remediation cannot be defined or has been agreed with the regulators at this stage, it is assumed that some contamination would remain. Therefore some contamination is considered to be present for the purposes of this assessment.

8.5.4 Unless there are any immediate (as yet unknown) unacceptable risks elsewhere (for instance off-site migration of mobile free phase hydrocarbons or vapour risk to adjacent properties), remediation in areas away from planned intrusive construction works would not take place prior to construction.

## Development of conceptual model

### Interactions between source-pathway-receptor

8.5.5 The following section outlines how the contamination sources summarised in paras. 8.4.5 to 8.4.13 may interact with the receptors identified during the construction phase (see para.8.4.17) following the application of the embedded measures (see Section 8.2).

8.5.6 The main land quality SPR interactions are considered to be from the exposure of potential contamination to:

a. construction workers (receptor) via dermal contact, ingestion, inhalation of dust and soil vapours/soil gas and direct contact

b. adjacent land-users, including members of the public (receptor) via off-site migration of soil vapour (by diffusion or due to wind) and wind-blown dust contaminant pathways as well as accidental UXO detonation

c. the built environment (on and off site receptors) via the accidental detonation of previously unidentified UXO or through the spread of Japanese Knotweed rhizome impacted soils excavated as part of construction works

8.5.7 The SPR interactions are summarised in Vol 22 Table 8.5.1. For simplicity the various sources identified have been grouped together into the different phases which they may be found (ie, solid, liquid, and gaseous), as these interact with receptors in a similar manner.

**Vol 22 Table 8.5.1 Land quality – source-pathway-receptor summary (construction)**

| Receptors / Generic sources | Construction workers | Adjacent land users | Built environment |
|---|---|---|---|
| **Contaminated soils** | Inhalation, dermal contact, ingestion | Wind-blown dust and vapour migration (and subsequent ingestion and inhalation) | N/A |
| **Contaminated groundwater or liquids** | Inhalation, dermal contact, ingestion | N/A | N/A |
| **Soil gases / vapours** | Inhalation | Vapour migration (and subsequent inhalation) | N/A |
| **UXO** | UXO | UXO detonation | UXO |

| Receptors / Generic sources | Construction workers | Adjacent land users | Built environment |
|---|---|---|---|
| | detonation | | detonation |
| **Japanese Knotweed** | N/A | N/A | Spread of rhizomes |

*N/A= Not applicable*

## Impacts and effects

8.5.8 The following section discusses the potential impacts and likely significant effects on receptors as a result of the existing land quality conditions at the site.

8.5.9 The assessment focuses on those linkages between sources, pathways and receptors that could generate significant effects and is based on available information and professional judgement.

### Construction workers

8.5.10 A number of embedded measures set out in the *CoCP* Section 9 are designed to effectively manage any potential land quality impacts to construction workers associated with the construction phase of the proposed development (measures are summarised in Section 8.2).

#### Contamination

8.5.11 The management of contamination at the site is a two stage process, the first stage comprises the assessment, quantification and if necessary the removal of the main contamination sources which could impact upon construction worker health.

8.5.12 The second stage comprises safe methods of work and management of contamination during construction (assuming that some contaminated soils could remain, or previously unidentified contamination be found, during the main construction works).

8.5.13 Both of these stages include measures such as site-specific risk assessments, watching brief, safe methods of work, use of PPE and mitigation from a specialist contractor who is experienced at managing such risks.

8.5.14 With these measures in place, the overall magnitude of the impact to construction workers (both below and above ground) is assessed to be negligible.

8.5.15 This would result in a **negligible** effect on above ground construction workers and a **minor adverse** effect on those involved in intensive below ground works (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).

#### UXO

8.5.16 The management of UXO risk comprises advice from a specialist contractor who is experienced at managing such risks. This would include an initial assessment of UXO being present at the site (such as that already undertaken) and a proportional response to this risk. With a high low/moderate risk site such as Earl Pumping Station this is likely to include of site-specific risk assessments, safe methods of work/tool box talks and emergency response procedure as well as a UXO watching brief as excavations progress.

8.5.17 These measures are successfully utilised in major construction schemes within London on regular basis. Therefore with these measures in place, the overall magnitude of the impact to construction workers (both below and above ground) is assessed to be negligible.

8.5.18 This would result in a negligible effect on above ground construction workers and a minor adverse effect on those involved in intensive below ground works (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).

### Adjacent land-users

#### Contamination

8.5.19 Impacts on adjacent land-users could occur via excavation and exposure of previously unidentified contaminated soils. This contamination could then migrate onto neighbouring sites. The pathways via which the contamination could migrate are: wind-blown dust and vapour diffusion.

8.5.20 A number of embedded measures set out in the *CoCP* Section 9, as summarised in Section 8.2, are designed to effectively manage any land quality impacts to the adjacent land-users associated with the construction phase of the proposed development.

8.5.21 These measures include:

a. the damping down of excavations, storage of potentially contaminated soils in secure (covered) areas, wheel washes at site entrance and the maintenance, construction and cleaning of hardstanding

b. dust and air/vapour monitoring to provide a check that volatile contamination or construction dusts do not significantly affect adjacent land users. Where appropriate, this would include a combination of on-site and boundary monitoring, which would provide either real time measurements or collect samples for subsequent analysis. For further detail and guidance reference should be made to the *CoCP* Section 9.

8.5.22 With these measures in place the overall magnitude of the impact to all adjacent land-users is assessed to be negligible.

8.5.23 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the adjacent light industrial/commercial land users and a **minor adverse** effect on the adjacent residential land users (although the effect is defined as minor adverse, it is considered unlikely that the effect would occur).

#### UXO

8.5.24 Impacts on adjacent land-users could occur via accidental detonation of UXO during below ground works. The embedded measures are set out in the *CoCP* Section 9, such as the use of specialised UXO contractors offering site-specific advice and where necessary on-site monitoring. These measures are designed to effectively manage any impacts to the adjacent land-users associated with the construction phase of the proposed development.

8.5.25 With these measures in place the overall magnitude of the impact to all adjacent land-users is assessed to be negligible.

8.5.26 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the adjacent light industrial/commercial land users and a **minor adverse** effect on the adjacent residential land users (although the effect is defined as minor adverse, it is considered unlikely that the effect would occur).

### Built environment

8.5.27 A number of embedded design measures set out in the *CoCP* Section 9, as summarised in Section 8.2, are designed to effectively manage any land quality impacts from UXO and Japanese Knotweed to the built environment associated with the construction phase of the proposed development.

#### UXO

8.5.28 Impacts from existing land quality relate to the accidental detonation of UXO during preliminary surveys or main construction works.

8.5.29 With the embedded design measures in place the overall magnitude of the impact to the built environment is assessed to be negligible.

8.5.30 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the Earl Pumping Station, adjacent residential buildings and light industrial/commercial units.

#### Japanese Knotweed

8.5.31 Impacts from existing land quality relate to the spread of Japanese Knotweed which, if left uncontrolled, can cause damage to structures and services.

8.5.32 With the embedded design measures in place the overall magnitude of the impact to the built environment is assessed to be negligible.

8.5.33 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the Earl Pumping Station, adjacent residential buildings and light industrial/commercial units.

## 8.6 Operational effects assessment

8.6.1 Operational effects have not been assessed for land quality (see para. 8.1.4).

## 8.7 Cumulative effects assessment

8.7.1 Of the projects described in Vol 22 Appendix N, which could potentially give rise to cumulative effects with the proposed development at Earl Pumping Station, three developments have been identified (see Vol 22 Table 8.3.1).

8.7.2 No cumulative land quality effects are expected during the construction of the Thames Tideway Tunnel project, since impacts are constrained to the footprint of the development by the measures incorporated in the *CoCP* Section 9.

## 8.8 Mitigation

8.8.1 The assessment presented above does not identify the need for mitigation during construction over and above those measures set out in the *CoCP* Section 9. No further mitigation, enhancement or monitoring is required.

## 8.9 Residual effects assessment

8.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 8.5. All residual effects are presented in Section 8.10.

## 8.10 Assessment summary

**Vol 22 Table 8.10.1 Land quality – summary of construction assessment**

| Receptor (sensitivity) | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Construction workers – general above ground site staff (Low) | Health effects from exposure to contaminated soils, liquids, soil gases / vapours | Negligible | None | Negligible |
| | Health effects from detonation of UXO | Negligible | None | Negligible |
| Construction workers – below ground site staff (High) | Health effects from exposure to contaminated soils, liquids, soil gases / vapours | Minor adverse | None | Minor adverse* |
| | Health effects from detonation of UXO | Minor adverse | None | Minor adverse* |
| Adjacent land-users, light industrial / commercial properties (Low) | Health effects from exposure to wind-blown dust or vapours | Negligible | None | Negligible |
| | Health effects from detonation of UXO | Negligible | None | Negligible |
| Adjacent land-users residential properties (High) | Health effects from exposure to wind-blown dust or vapours | Minor adverse | None | Minor adverse* |
| | Health effects from detonation of UXO | Minor adverse | None | Minor adverse* |
| Built environment, existing Earl Pumping Station building, residential and commercial buildings (Low) | Damage to structures from detonation of UXO during construction works | Negligible | None | Negligible |
| | Damage to structures from the spread of Japanese Knotweed | Negligible | None | Negligible |

**Although the effect is minor adverse, it is considered unlikely that the effect would occur.*

# References

[1] Defra. *National Policy Statement for Waste Water* (2012).

[2] Environment Agency. *Model procedures for the management of land contamination: Contaminated Land Report 11* (2004).

**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 9: Noise and vibration

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

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January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 9: Noise and vibration

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# 9 Noise and vibration

## 9.1 Introduction

9.1.1 This section presents the findings of the assessment of the likely significant effects of noise and vibration at the Earl Pumping Station site.

9.1.2 The proposed development has the potential to affect noise and vibration levels at receptors due to:

a. construction site activities (noise and vibration)

b. construction traffic on roads outside the site (noise)

c. operation of the proposed development (noise and vibration).

9.1.3 Each of these is considered within the assessment.

9.1.4 The tunnel drive for the Greenwich connection tunnel runs beneath this location. Groundborne noise and vibration from the tunnelling activities associated with the main tunnel, long connection tunnels and certain short connection tunnels are considered in Volume 3 Project-wide effects assessment.

9.1.5 There are no river services in the vicinity of the Earl Pumping Station site and it is not proposed to use the river to transport materials at this site; therefore, effects as a result of river-based construction traffic are not considered at this site.

9.1.6 The assessment of noise and vibration presented in this section has considered the requirements of the National Policy Statement for Waste Water Section 4.9 (noise and vibration) (Defra, 2012)[1]. Further details of these requirements can be found in Volume 2 Environmental assessment methodology Section 9.3.

9.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

## 9.2 Proposed development relevant to noise and vibration

9.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to noise and vibration are set out below.

### Construction

#### Construction traffic

9.2.2 The delivery and removal of all materials would be by road. Estimated vehicle numbers and haul routes are presented in Vol 22 Sections 3.3 and 12.2.

### Construction activities

9.2.3 Vol 22 Section 3.3 sets out the assumed construction duration and programme for the Earl Pumping Station site.

9.2.4 The construction works at this location would involve the following activities that have the potential to affect noise and vibration levels in the vicinity of the site:

a. utility diversions

b. hoarding and site setup

c. demolition

d. shaft construction and excavation

e. shaft secondary lining

f. interception chamber and culvert works

g. landscaping (including construction and fit-out of permanent facility).

9.2.5 Further detail on the plant used in these construction stages is given in Vol 22 Appendix G.

9.2.6 Working hours have been subject to consultation with the local authority. As part of the *Code of Construction Practice (CoCP)*[i] requirements, Section 61 consents would be agreed with the local authority to confirm methodologies. Construction activities would be carried out during the following periods, as identified in the *CoCP:*

a. standard (core) hours (08.00-18.00 weekdays and 08.00-13.00 Saturdays) as identified in the *CoCP*

b. extended working hours (18.00-22.00 weekdays, 13.00-17.00 Saturdays) to complete large concrete pours. These are assumed to occur twice a week for three months during the diaphragm walling works and then once a month for other major concrete pours. .

### Code of Construction Practice

9.2.7 The *CoCP Part A* (Sections 4.3 and 6.4) specifies the use of best practicable means (BPM) to reduce noise and vibration effects. Generic measures include:

a. careful selection of construction plant construction methods and programming

b. equipment would be suitably sited so as to minimise noise impact on sensitive receptors

c. use of site enclosures, and temporary stockpiles., to provide acoustic screening

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[i] The *Code of Construction Practice (CoCP)* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

d. choice of routes and programming for the transportation of construction materials, excavated material and personnel to and from the site

e. careful programming so that activities which may generate significant noise would be planned with regard to local occupants and sensitive receptors.

f. hoarding would be of a height and extent to achieve appropriate noise attenuation.

9.2.8 Site specific measures incorporated into the *CoCP Part B* (Sections 4 and 6) to reduce noise and vibration effects include:

a. the site hoarding adjacent to 62 Croft Street would be approximately 3.6m. The rest of the site hoarding would be 2.4m.

b. the hoarding on the south boundary would be reviewed depending on development proposals and the progress of adjacent land

c. compaction of material on site would be undertaken using machinery generating the lowest practicable vibration levels which still enables the required level of compaction to be completed. Specifically, the use of large twin-drum vibrating rollers would only occur on occasions where vibration levels can be controlled to less than the impact criteria

## Operation

9.2.9 A ventilation structure would be constructed to contain plant and air management equipment above the shaft. Three ventilation columns are also proposed. The operational plant installed would have the potential to create noise impacts, and these are considered in the assessment.

9.2.10 During tunnel filling events water would descend via a vortex structure through the drop shaft to the connection shaft below. The potential for noise generated by this movement of water through the shaft has been assessed.

### Environmental design measures

9.2.11 The operational plant associated with the surface structures would incorporate environmental design measures to control noise emission to the nearest sensitive receptors to acceptable noise limits. These limits are as defined by the Local Authority in which the receptor lies. At Earl Pumping Station, the receptors lie within the London Borough (LB) of Lewisham and the LB of Southwark (see para 9.3.16). The environmental design measures have considered the following noise sources:

a. hydraulic plant for penstock operation (pumps, motors)

b. uninterruptable power supply (UPS) plant.

9.2.12 In considering the noise from the above items, the sound insulation of the housing for the equipment has been taken into consideration.

9.2.13 The design of the drop shaft would control the descent of water by channelling the flow around the internal face of a vortex drop tube within the drop shaft, rather than allowing the water to free fall. The vortex design allows large volumes of water to descend with less noise generation than a falling cascade design.

## 9.3 Assessment methodology

### Engagement

9.3.1 Vol 2 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of noise and vibration are presented here.

9.3.2 The survey methodology and monitoring locations, and limits for plant noise from the operation of the site were agreed with LB of Lewisham (see para. 9.3.16).

9.3.3 A response was not received from LB Southwark and as such operational limits for plant noise were determined according to the general methodology outlined in Vol 2 (see para. 9.3.17).

9.3.4 Consultation comments relevant to this site for the assessment of noise and vibration are presented in Vol 22 Table 9.3.1.There were no other site specific comments from stakeholders in relation to noise and vibration raised at scoping or other consultation stages.

**Vol 22 Table 9.3.1 Noise and vibration – Consultation comments**

| Organisation | Comment | Response |
|---|---|---|
| LB of Southwark, phase two consultation, February 2011 | The *Preliminary environmental information report* identifies that there will be significant noise effects arising from construction activities for properties located within Southwark, including those properties on Chilton Grove immediately adjacent to the north west and south west boundaries of the site. Significant vibration impacts are also predicted from the construction works. No acceptable details are currently provided of how such impacts upon Southwark residents will be successfully mitigated and objection is therefore raised given the adverse impacts that would be likely to result for the adjacent residents | Measures to reduce the impact of noise and vibration have been included as part of the assessed scheme, and are detailed in the *CoCP* Parts A and B. This is summarised in para. 9.2.7. |
| LB of Lewisham, phase two response, February 2011 | The impact of construction noise has not been assessed in relation to the proposed residential developments on surrounding and adjacent sites. These | The assessment of construction noise, to the existing residential receptors and |

| Organisation | Comment | Response |
|---|---|---|
| | properties should be included in order to identify the full number of sensitive properties. The properties that have been assessed LB of Southwark however the Croft Street residences are within the LB of Lewisham and should be identified as such. | those identified in the site development schedule (Vol 22 Appendix N) as complete at the start or during the construction of the development, has been carried out in line with the methodology in Vol 2. Receptors around the perimeter of the site have been identified for the operational assessment. For operational noise it is considered that by meeting the requirements in para 9.3.16 at these receptors, there would be no effects identified at further receptors. |
| LB of Lewisham, phase two response, February 2011 | The works producing the most noise will last for around 15 months of the 4 year construction period. Thames Water have identified the noise effects as being significant on all the residential properties assessed and the vibration effects as being significant on many of the residential properties around the site, Further information regarding any proposed mitigation is required. | Measures to reduce the impact of noise and vibration have been included as part of the assessed scheme, and are detailed in the *CoCP* Parts A and B. This is summarised in para. 9.2.7 |
| LB of Lewisham, phase two response, February 2011 | The compaction works have been identified as giving rise to relatively high levels of exposure. Further information is required regarding the method and design for compaction works to reduce the noise and vibration impact. | The compaction works used in this assessment have assumed vibratory compaction to form a reasonable worst-case |

| Organisation | Comment | Response |
|---|---|---|
| | | assessment. Where significant effects have been identified, alternative methods are proposed in order to reduce the impact from this activity. |
| LB of Lewisham, phase two response, February 2011 | A full assessment of the noise and vibration effects on the existing and proposed residential properties is required and unless it can be demonstrated that the impacts of the proposal can be satisfactorily mitigated, the proposal will be contrary to Lewisham's retained UDP policy ENV.PRO1 1 which seeks to resist development that would lead to unacceptable levels of noise. | This volume presents the assessment of noise and vibration from the proposed scheme, alongside all proposed mitigation measures for the construction and operation of the development. |

## Baseline

9.3.5 The baseline methodology follows the methodology provided in Vol 2. There are no site specific variations for this site.

9.3.6 As described in Vol 2, the significance of noise effects at residential receptors is based on the predicted impact and other factors, such as, the construction noise level relative to the significance threshold, and the numbers and types of receptors affected.

## Construction

9.3.7 The assessment methodology for the construction phase follows that described in Vol 2. There are no site specific variations for undertaking the construction assessment of this site.

9.3.8 Section 9.5 details the likely significant effects arising from the construction at the Earl Pumping Station. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on noise and vibration within the assessment area for this site; therefore, no other Thames Tideway Tunnel project sites have been considered in this assessment.

9.3.9 The construction noise and vibration assessment has considered the effects across the whole duration of the construction phase (Years 1 to 4) with the worst-case exposure levels reported.

9.3.10 Of the schemes outlined in the site development schedule (Vol 22 Appendix N), Block J of the Cannon Wharf residential development is considered relevant to the construction assessment base case as it is the closest of the blocks assumed to be complete and operational during Site Year 1 of construction. The other schemes are either screened by receptors closer to the site, or are outside of the 300m assessment area.

9.3.11 Of the schemes outlined in the site development schedule (Vol 22 Appendix N), the Cannon Wharf and Yeoman Street residential developments are considered relevant to the construction cumulative assessment as it is assumed to be under construction during the construction of the Thames Tideway Tunnel project. The other schemes are either screened by receptors closer to the site, or are outside of the 300m assessment area.

9.3.12 Traffic flows on construction traffic routes have been examined to determine if there are any routes where there is the potential for traffic noise changes of 1dB(A) or more. This is according to the flow, speed or composition change criteria specified in Vol 2. The results show that there are no traffic changes on the road network associated with this site which meet the relevant criteria. This is discussed further in the assessment section from para 9.5.40.

9.3.13 The assessment of construction effects also considers the extent to which the effects on noise and vibration would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

### Construction assessment area

9.3.14 As described in Vol 2 the assessment area considers unscreened receptors up to a maximum of 300m from the site boundary based on professional judgement of the likelihood of significant effects. The assessment primarily concentrates on those receptors closest to the site which would generally be most affected, rather than those further away which would be well screened by intervening buildings. Effects at more distant receptors beyond those closest to the site have been considered where necessary by reference to the impacts determined at the primary (closest) receptors.

## Operation

9.3.15 The operational phase assessment methodology follows the methodology provided in Vol 2. Site specific variations to this methodology are set out below.

9.3.16 For this site, LB of Lewisham requires that noise emissions from this type of source are designed to meet a rating level (as defined in BS4142[2]) which is 5dB below the typical background noise level over the operational period of the plant at 1m from the facade of the nearest residential receptor.

9.3.17 A response has not been received from LB of Southwark (LB of Southwark) specifying their requirements for the control of noise from fixed plant noise sources. Vol 2 - Environmental assessment methodology refers to a proposed approach where guidance has not been received from the local authority. This approach is that noise emissions from this type of source are designed to meet a rating level (as defined in BS4142[1]) which is 5dB below the typical background noise level over the operational period of the plant at 1m from the facade of the nearest residential receptor.

9.3.18 The operational assessment year is taken to be Year 1 of operation.

9.3.19 Section 9.6 details the likely significant effects arising from the operation of the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on noise and vibration within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

9.3.20 Of the schemes outlined in the site development schedule (Vol 22 Appendix N), the Cannon Wharf development and the Yeoman Street residential development would be completed by Year 1 of operation have been included as receptors in the operational assessment base case. The other schemes are either screened by receptors closer to the site, or are outside of the 300m assessment area

9.3.21 There are no developments relevant to the operational cumulative assessment for noise and vibration at this site because due to their use, none are expected to generate significant noise or vibration levels during their operation.

9.3.22 Based on the traffic flow, speed or composition change criteria specified in Vol 2, there are no routes where potential for operational traffic noise effects would occur.

9.3.23 The assessment of operational effects also considers the extent to which the effects on noise and vibration would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

### Operational assessment area

9.3.24 Operational effects are considered up to 300m from the site boundary, although the focus is on the closest receptors.

## Assumptions and limitations

9.3.25 The generic assumptions and limitations associated with this assessment are presented in Vol 2. The site specific assumptions are presented in the following section.

### Assumptions

9.3.26 The working hours assumed for the assessment are as described in para. 9.2.6.

### Limitations

9.3.27 A response has not been received from LB Southwark with regards to noise monitoring locations and the borough's limits for noise from operational plant. As discussed in para. 9.3.17 a general methodology for selecting monitoring locations and determining limits for operational noise (set out in Vol 2) has been applied and as such the assessment is considered robust.

## 9.4 Baseline conditions

9.4.1 The following section sets out the baseline conditions for noise and vibration within and around the site. Future baseline conditions (base case) are also described.

### Current baseline

9.4.2 The current baseline noise conditions are as described in the baseline survey. The specific details of this survey, such as the measurement times, locations measured, results and local conditions are described in Vol 22 Appendix G. Vol 22 Table 9.4.1 below shows that the noise levels for the daytime and evening period are relatively similar around the site, the noise levels being influenced by distant traffic noise from Plough Way, Lower Road and local roads in the vicinity.

#### Receptors

9.4.3 This section describes the setting and receptor characteristics of the site for the purposes of this assessment.

9.4.4 The closest noise and vibration sensitive receptors selected for the noise and vibration assessment are identified in Vol 22 Table 9.4.1 below (and shown in plan view in Vol 22 Figure 9.4.1 – see separate volume of figures). These were selected as they are representative of the range of noise climates where sensitive receptors are situated around the site. The approximate number of residential properties affected at each location (where known) is indicated in Vol 22 Table 9.4.2.

9.4.5 The nearest residences to the site are on Chilton Grove and west side of Croft Street which are in the LB of Southwark, the residences on the eastern side of Croft Street are in the borough of LB of Lewisham. The Cannon Wharf development would lie adjacent to the site on the south west boundary. The Yeoman Street development would lie to the east of the site.

9.4.6 Beyond these closest receptors there are other properties which are screened from the site by intervening buildings, or are located further from the site than the buildings included in the assessment and these have not been assessed.

#### Receptor sensitivity

9.4.7 The noise and vibration sensitive receptors have been assessed according to their sensitivity, using the methodology outlined in Vol 2 Section 9.4. The sensitivities of all assessed receptors are presented in Vol 22 Table 9.4.1.

**Vol 22 Table 9.4.1 Noise and vibration- sensitive receptors and noise levels**

| Ref | Receptor addresses | Sensitivity | Local authority | Measured average ambient noise level, day/ evening dB$L_{Aeq}$* | Noise survey location |
|---|---|---|---|---|---|
| EP1 | 18-32 Yeoman Street (residential) | High | LB Southwark | 62/56 | EPS01 |
| EP2 | 1-39 Chilton Grove (residential) | High | LB Southwark | 61/60 | EPS02 |
| EP3 | 108-136 Chilton Grove (residential) | High | LB Southwark | 62/60 | EPS03 |
| EP4 | 52-62 Croft Street (residential) | High | LB Lewisham | 60/62 | EPS04 |
| EP5 | Cannon Wharf block J (residential) | High | LB Lewisham | 62/56 | EPS01 |
| EP6 | Yeoman Street (residential – under construction**) | High | LB Lewisham | 62/56 | EPS01 |

** Noise level includes correction for façade acoustic reflection unless receptor position is an open outdoor space (eg park)*
*** Assessed for operational effects only.*

9.4.8 The baseline noise level is considered representative of the relevant receptor. Consideration is given to the distance of the measurement location to the receptor, the orientation of the primarily affected façade and location of the controlling noise source(s).

9.4.9 The criteria for determining the significance of noise effects at residences from construction sources are partly dependent upon the existing ambient noise levels. From the ambient noise levels measured during the baseline survey, the assessment category and assessment noise threshold levels for the residential receptors near the Earl Pumping Station site are as shown in Vol 22 Table 9.4.2. As described in the assessment methodology, this follows the method as described in Vol 2 Section 9.5.

**Vol 22 Table 9.4.2 Noise - residential receptors and assessment categories**

| Ref | Noise sensitive receptor (No. of dwellings) | Ambient noise level, rounded to nearest 5dB$L_{Aeq}$* day/ evening | Assessment category* day/ evening | Impact criterion threshold level**, day, dB$L_{Aeq\ 10hour}$/ evening dB$L_{Aeq\ 1hour}$ |
|---|---|---|---|---|
| EP1 | 18-32 Yeoman Street (8) | 60/55 | A/B | 65/60 |
| EP2 | 1-39 Chilton Grove (39) | 60/60 | A/C | 65/65 |
| EP3 | 108-136 Chilton Grove (24) | 60/60 | A/C | 65/65 |
| EP4 | 52-62 Croft Street (5) | 60/60 | A/C | 65/65 |
| EP5 | Cannon Wharf block J (TBC) | 60/55 | A/B | 65/60 |
| EP6 | Yeoman Street (33) under construction | -*** | -*** | -*** |

** From 'ABC' method – BS5228:2009*[3]
***Where the ambient noise level is greater than category C levels the ambient noise level shall be used as the significance criterion threshold.*
**** Assessed for operational effects only.*

## Construction base case

9.4.10 The construction base case taking into account the schemes described in Section 9.3 would include, Cannon Wharf block J which is expected to be completed by Site Year 1 of construction.

9.4.11 The noise levels, as measured during the baseline noise survey in 2011, are assumed for the base case. However, there is the potential for variations to occur in the ambient noise levels between 2011 and the base case year. If the noise levels were to vary, it is likely that they would increase compared to the measured data from 2011 (due to natural traffic growth and the potential for additional construction noise from adjacent developments). The estimated traffic increases for the construction base case in Site Year 1 are such that noise levels would be expected to increase by less than 1dB(A) from those measured in 2011. The assessment based on data from 2011 therefore presents a worst-case assessment.

9.4.12 It is considered that there are no other circumstances at this location that would cause the baseline noise levels at the receptor locations to change significantly between 2011 and the first year of construction.

9.4.13 No existing major vibration sources have been identified. It is therefore considered that vibration levels are unlikely to change between the present time and the base case.

### Operational base case

9.4.14 The operational base case taking into account the schemes described in Section 9.3 would include the Cannon Wharf and Yeoman Street developments which are expected to be completed by Year 1 of operation.

9.4.15 The base case in Year 1 of operation has been estimated from traffic flow expectations for the Year 1 of the operational phase as a result of natural growth and new development in the vicinity. The estimated traffic increases for the operational base case in year 1 of operation are such that noise levels would be expected to increase by less than 1dB(A) from those measured in 2011.

## 9.5 Construction effects assessment

### Noise

9.5.1 The results of the assessment of construction noise are presented in Vol 22 Table 9.5.1. The table shows the range of predicted construction noise levels during the entire period of the works and a typical monthly construction noise level. The typical monthly level is the most frequently occurring monthly noise level during the works. The table also shows the total number of months across all construction stages that the noise level would be likely to exceed the impact criterion threshold level indicating potential significance. The final column in the table shows the worst-case excess above the impact criterion together with the duration of the worst-case noise level. In cases when the impact criterion is exceeded (as marked by an asterisk in Vol 22 Table 9.5.1), further assessment of the likely noise ingress would depend in the degree of façade insulation of the particular buildings which is considered in further detail in these cases..

9.5.2 To illustrate the predicted variation in construction noise levels at each receptor position across the duration of the construction phase, Vol 22 Appendix G.2, Vol 22 Plates G.5 to G.8 show the estimated noise levels plotted month-by-month over the duration of the works. The appendix also lists the construction plant and operations assumed for the calculations.

9.5.3 The predicted impacts and assessed effects at each representative receptor location are described below.

#### Impacts at residential receptors

9.5.4 The results for residential receptors are shown below.

**Vol 22 Table 9.5.1 Noise – impacts at residential receptors (high sensitivity)**

| Ref/ receptor[a] (No. of noise sensitive properties) | ABC impact criterion threshold level (potential significance for residential), $dBL_{Aeq}$[b] | Range of construction noise levels, $dBL_{Aeq}$[c,d] | Typical[e] monthly construction noise levels, $dBL_{Aeq}$ | Magnitude | | |
|---|---|---|---|---|---|---|
| | | | | Total duration above criterion for all works, months | Worst-case excess above criterion, $dBL_{Aeq}$[f] (further assessment undertaken for excess above criterion*) | Duration of worst-case excess above criterion, months |
| EP1/ 18-32 Yeoman Street (8) | 65 | 57 - 64 (day) | 61 | 0 | -1 | 0 |
| | 60 | 58 (eve) | 58 | 0 | -2 | 0 |
| EP2/ 1-39 Chilton Grove (39) | 65 | 65 – 74 (day) | 70 | 48 | +9* | 4 |
| | 65 | 59 (eve) | 59 | 0 | -6 | 0 |
| EP3/ 108-136 Chilton Grove (24) | 65 | 69 – 79 (day) | 71 | 48 | +14* | 4 |
| | 65 | 64 (eve) | 64 | 0 | -1 | 0 |
| EP4/ 52-62 Croft Street (5) | 65 | 61 - 71 (day) | 62 | 13 | +6* | 4 |
| | 65 | 57 (eve) | 57 | 0 | -8 | 0 |
| EP5 / Cannon Wharf block J (TBC) | 65 | 62-77 (day) | 65 | 19 | +12 | 1 |
| | 60 | 63 (eve) | 63 | 1 | +3 | 1 |

*a Floors subject to highest noise level assessed – not necessarily the highest floor level*
*b The potential significance threshold is based on the ambient noise level as defined in Vol 2*
*c Construction noise only, excludes ambient noise. Refer to Vol 2 Section 9.5*
*d Noise level includes correction for façade acoustic reflection*
*e Most frequently occurring monthly construction noise level during works*
*f Positive value indicates exceedance, negative value indicates noise below criterion*

### 18-32 Yeoman Street (EP1)

9.5.5 The residences on Yeoman Street are four storey buildings located 20m from the site boundary, and approximately 60m from the shaft. The upper floors would have partial view of the site, although the majority would be screened by the site hoarding and the pumping station. The predicted noise levels at these dwellings due to construction activities are shown in Vol 22 Table 9.5.1.

9.5.6 The typical daytime noise levels (most frequently occurring monthly level) is 61dB$L_{Aeq}$. The site establishment works are expected to cause the worst-case noise level of 64dB$L_{Aeq}$ for five months.

9.5.7 During the evening, diaphragm walling is expected to cause the worst-case noise level of 58dB$L_{Aeq}$.

9.5.8 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor during the day or evening. The effect is therefore **not significant.**

9.5.9 There are no other residential properties in the vicinity close enough to be subject to significant adverse effects.

### 1-39 Chilton Grove (EP2)

9.5.10 The residential building at 1-39 Chilton Grove is a five storey building located approximately 20m from the site boundary, and 60m from the shaft. The upper floors would have a view of the site, whereas the lower floors would be screened by the site hoarding. The predicted noise levels at these dwellings due to construction activities are shown in Vol 22 Table 9.5.1.

9.5.11 The typical daytime noise levels (most frequently occurring monthly level) is 70dB$L_{Aeq}$. The construction of the shaft is expected to cause the worst-case noise level of 74dB$L_{Aeq}$ for four months.

9.5.12 During the evening, diaphragm walling is expected to cause the worst-case noise level of 59dB$L_{Aeq}$.

9.5.13 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the daytime for the total construction period.

9.5.14 As potentially significant effects have been identified using the ABC criterion, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2. Thermal double glazing has been assumed for this receptor (based on the age of the property and external observations) and takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.15 The worst-case internal noise level during the day is estimated to be 42dB$L_{Aeq}$ for four months with windows closed or approximately 56dB$L_{Aeq}$ if windows were opened on the most exposed façade. This impact occurs for four months and is over the BS 8233 internal guidance noise level[4] of

40dBL$_{Aeq.}$ This is assessed as causing a **significant** effect given the number of affected residences.

9.5.16 Other than those assessed there are no other residential properties in the vicinity of this receptor (excepting those considered below) that are close enough to also be subject to significant adverse effects.

### 108-136 Chilton Grove (EP3)

9.5.17 The residential building at 108-136 Chilton Grove is a six storey building located 25m from the site boundary. The upper floors would be unscreened from the site; the lower floors would be screened by the site hoarding. The predicted noise levels at these dwellings due to construction activities are shown in Vol 22 Table 9.5.1.

9.5.18 The typical daytime noise levels (most frequently occurring monthly level) is 71dBL$_{Aeq}$. Construction of the shaft is expected to cause the worst-case noise level of 79dBL$_{Aeq}$

9.5.19 During the evening, diaphragm walling is expected to cause the worst-case noise level of 64dBL$_{Aeq}$.

9.5.20 The construction noise levels are estimated to exceed the ABC potential significance criteria for a residential receptor during the daytime for the total construction period.

9.5.21 As potentially significant effects have been identified using the ABC criterion, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2. Thermal double glazing has been assumed for this receptor (based on the age of the property and external observations) and takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.22 The worst-case internal noise level during the day is estimated to be 45dBL$_{Aeq}$ for four months with windows closed or approximately 61dBL$_{Aeq}$ if windows were opened on the most exposed façade. As this impact is over the internal guidance noise level of 40dBL$_{Aeq,}$ this is assessed as causing a **significant** effect given the number of affected residences.

9.5.23 Other than those assessed there are no other residential properties in the vicinity of the receptor (excepting those considered below) close enough to be subject to significant adverse effects.

### 52-62 Croft Street (EP4)

9.5.24 The residences on the eastern side of Croft Street are two storey buildings, the closest of which are located on the southern site boundary. The upper floors would have a partial view of the site, although the majority of the site would be screened by the site hoarding. The predicted noise levels at these dwellings due to construction activities are shown in Vol 22 Table 9.5.1.

9.5.25 The typical daytime noise levels (most frequently occurring monthly level ) is 62dB$L_{Aeq}$. Daytime construction of the shaft is expected to cause the worst-case noise level of 71dB$L_{Aeq}$.

9.5.26 During the evening, diaphragm walling is expected to cause the worst-case noise level of 57dB$L_{Aeq}$.

9.5.27 The construction noise levels are estimated to exceed the ABC potential significance criteria for a residential receptor during the day for 13 months.

9.5.28 As potentially significant effects have been identified using the ABC criterion, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2. This receptor is assumed to have a sealed façade (based on external observations).

9.5.29 The worst-case internal noise level during the day is estimated to be 40dB$L_{Aeq}$ for four months with windows closed or approximately 53dB$L_{Aeq}$ if windows were opened on the most exposed façade with windows closed Although this impact does not exceed the internal guidance noise level of 40dB$L_{Aeq,}$ it is assessed as a **significant** effect given the level of impact (increase) and the duration at this noise level.

9.5.30 Other than those assessed there are no other residential properties in the vicinity of this receptor that are close enough to be subject to significant adverse effects.

### Cannon Wharf Block J (EP5)

9.5.31 The residential building at Block J of Cannon Wharf would be located adjacent to the site boundary, approximately 40m from the shaft. The upper floors would be unscreened from the site; the lowest floor would be screened by the site hoarding. The predicted noise levels at these dwellings due to construction activities are shown in Vol 22 Table 9.5.1.

9.5.32 The typical daytime noise levels (most frequently occurring monthly level) is 65dB$L_{Aeq}$. The site establishment works will occur adjacent to the building and these are expected to cause the worst-case noise level of 77dB$L_{Aeq.}$

9.5.33 During the evening, diaphragm walling is expected to cause the worst-case noise level of 63dB$L_{Aeq}$.

9.5.34 The construction noise levels are estimated to exceed the ABC potential significance criteria for a residential receptor during the daytime for 19 months, and during the evening for one month.

9.5.35 As potentially significant effects have been identified using the ABC criterion, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2. Thermal double glazing has been assumed for this receptor (based on the age of the property and external observations) and takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.36 The worst-case internal noise level during the day is estimated to be 45dB$L_{Aeq}$ for one month with windows closed or approximately 59dB$L_{Aeq}$ if windows were opened on the most exposed façade. During other periods when the noise level exceeds the ABC potential significance threshold, internal noise levels would range between 38 and 34dB$L_{Aeq}$ with windows closed.

9.5.37 During the evening, the worst-case internal noise level is estimated to be 31dB$L_{Aeq}$ for one month with windows closed or approximately 45dB$L_{Aeq}$ if windows were opened on the most exposed façade.

9.5.38 Given the internal noise levels during the day, the level of noise impact (increase) during the day and the duration of exceedance of the ABC criterion, this effect is assessed as **significant.**

9.5.39 Other than those assessed there are no other residential properties in the vicinity of the receptor close enough to be subject to significant adverse effects.

### Road-based construction traffic

9.5.40 The location of the site at Earl Pumping Station provides direct access to the major road network through London. The construction programme would result in varying traffic generation over a period of four years. During the peak construction period the traffic generation is forecast to average 34 heavy vehicles (HGVs) per day (equivalent 68 movements per day).

9.5.41 The major road links adjacent to and leading to the site are Lower Road, Rotherhithe New Road, Rotherhithe Old Road, Plough Way, Evelyn Street, Hawkstone Road and Bestwood Street, Vehicles would use Yeoman Street, a local road, to access the site.

9.5.42 A flow change of about 25% is required to cause a change in noise level of 1dB and by 100% to cause a change of 3dB, which is considered to be the minimum change perceptible to the human ear. Additionally, a change in HGV composition of 5% is also considered to cause a change in noise level of approximately 1dB.

9.5.43 The traffic modelling shows that the 18hr flow on Yeoman Street, which is the link adjacent to the site, is currently just over 1,000 vehicles per day (vpd), with average speeds of 20 mph (32 kph) and 11.4% HGVs. The total number of HGVs is therefore currently 120 per day.

9.5.44 Evelyn Street has the highest flow, with just over 25,000 vpd and 11.6% HGVs. The flow on other links is relatively similar. However, four links have flows below 6,000 vpd. Several links have similarly high HGV percentages, although the majority of links have smaller HGV percentages.

9.5.45 The modelling of construction traffic on these links shows that the highest percentage increase in total flow due to construction traffic would occur on Yeoman Street, assuming that all worker cars and office/operational light vehicles from Lower Road travel down Plough Road and Yeoman Street, which is a conservative assumption. The current flow on Yeoman Street is currently just above 1,000 vpd. The average daily number of construction HGV movements on this link during the peak month of construction is 68 and the daily number of worker cars and office/operational light vehicles is 20, with the number of cars and light vehicles consistent across the construction period. This represents a percentage increase in flow of 8%.

9.5.46 The modelling of the construction traffic on these links shows that the highest increase in HGV proportion would also occur on Yeoman Street. The average daily number of construction HGVs on this link during the peak month of construction is 68 which, taking into account the number of worker cars and office/operational light vehicles, represents an increase in HGV proportion of 5%.

9.5.47 The change in the HGV composition of 5% is likely to cause a change in noise level of 1dB. However the increase in composition of 5% would not be sufficient to cause a 3dB increase in noise levels. Therefore traffic noise change is assessed as **not significant**.

## Vibration

9.5.48 The assessment of construction vibration considers events which have the potential to cause human disturbance, or damage to buildings and structures. The assessments of human disturbance and effects on building structures are carried out separately using different parameters.

9.5.49 The assessment has been conducted using the methodology defined in Vol 2.

9.5.50 The assessment of human disturbance due to construction vibration impacts at neighbouring receptors has been assessed using the predicted estimated Vibration Dose Value (eVDV). The results from the assessment are presented in Vol 22 Table 9.5.2.

**Vol 22 Table 9.5.2 Vibration – impact and magnitude of human response to vibration impacts**

| Ref | Receptor | Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)* | Value/ sensitivity | Magnitude |
|---|---|---|---|---|
| EP1 | 18-32 Yeoman Street | <0.4 | High | Low probability of adverse comment - No impact |
| EP2 | 1-39 Chilton Grove | <0.4 | High | Low probability of adverse comment - No impact |
| EP3 | 108-136 Chilton Grove | <0.4 | High | Low probability of adverse comment - No impact |

| Ref | Receptor | Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)* | Value/ sensitivity | Magnitude |
|---|---|---|---|---|
| EP4 | 52-62 Croft Street | 4.5 | High | Adverse comment probable - Impact |
| EP5 | Cannon Wharf, block J | 4.5 | High | Adverse comment probable - Impact |

**Most affected floor*

9.5.51 The predicted eVDV levels at residences on Yeoman Street and Chilton Grove fall within the 'Low probability of adverse comment' band, as described in Vol 2 and therefore significant effects are not anticipated at these locations.

9.5.52 The predicted eVDV levels at residences on 52-62 Croft Street and block J Cannon Wharf are greater than the 'Adverse comment probable' band for the respective building use, as described in Vol 2. The *CoCP Part A* seeks to ensure that piling methods which limit noise and vibration are selected where possible (*CoCP Part A* para 6.4.3d). If ground conditions at the Earl Pumping Station site are such that these methods could be implemented, effects would not be significant. However as the specific ground conditions encountered would not be known until piling is underway, it cannot be guaranteed that these measures can be implemented. Therefore, in the worst case, **significant** effects would arise from piling at this location.

9.5.53 The assessment of potential construction vibration effects at adjacent buildings / structures has been assessed using the predicted Peak Particle Velocity (PPV), according to the criteria given in Vol 2. The results of the assessment of construction vibration are presented in Vol 22 Table 9.5.3.

**Vol 22 Table 9.5.3 Vibration – building vibration impacts and their magnitudes**

| Ref | Receptor | Impact (highest predicted PPV across all activities, mm/s) | Value/ sensitivity | Magnitude |
|---|---|---|---|---|
| EP1 | 18-32 Yeoman Street | <0.5 | High | Below threshold of potential cosmetic damage - No impact |
| EP2 | 1-39 Chilton Grove | <0.5 | High | Below threshold of potential |

| Ref | Receptor | Impact (highest predicted PPV across all activities, mm/s) | Value/ sensitivity | Magnitude |
|---|---|---|---|---|
| | | | | cosmetic damage - No impact |
| EP3 | 108-136 Chilton Grove | <0.5 | High | Below threshold of potential cosmetic damage - No impact |
| EP4 | 52-62 Croft Street | <3.0 | High | Below threshold of potential cosmetic damage – No impact |
| EP5 | Cannon Wharf block J | <3.0 | High | Below threshold of potential cosmetic damage – No impact |

9.5.54 The vibration levels reported here are well below the levels likely to cause cosmetic building damage according to the criteria described in Vol 2.

9.5.55 Vibration effects are not significant to any receptors with the exception of the effects on occupants (not building structure) at 52-62 Croft Street and block J Cannon Wharf. A **significant** effect is assessed at these locations.

### Sensitivity test for programme delay

9.5.56 In considering the effects of a delay to the Thames Tideway Tunnel project of approximately one year, there is the potential that a few more blocks of the Cannon Wharf development would be complete and operational (thus creating new receptors) when construction of the delayed Thames Tideway Tunnel project would start. However these phases are further from the site than Block J which is already assessed above and as such a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors.

## 9.6 Operational effects assessment

### Impacts from potential noise and vibration sources

9.6.1 The following section describes the potential noise and vibration effects from various sources identified for assessment.

### Noise from operational plant at above ground structures

9.6.2 A passive system is to be installed at Earl Pumping Station and therefore there is no requirement to install active ventilation equipment for the drop shaft at this location.

9.6.3 The appropriate emission limits are shown below in Vol 22 Table 9.6.1, based on local authority requirements to ensure that no adverse effects would occur. As there is no active ventilation plant for the drop shaft to generate noise at this site, these limits would only apply to any minor plant equipment. If cooling fans are required this equipment would be controlled to meet the criteria in Vol 22 Table 9.6.1, although such small fans would be expected to have a relatively low noise emission (approximately 45dB(A) at 3m).

9.6.4 The prediction method and assumptions are described in Vol 2 . Vol 22 Table 9.6.1 shows, for each receptor, that the estimated plant noise level is below the local authority limit or is less than ambient levels for residential and non-residential receptors respectively.

**Vol 22 Table 9.6.1 Noise – operational airborne noise impacts**

| Ref | Receptor | Lowest baseline noise level | Impact | Value/ sensitivity | Magnitude |
|---|---|---|---|---|---|
| EP1 | 18-32 Yeoman Street | Night time noise levels not measured at this location | Plant noise emission to be designed to a rating level at receptor 5dB below the typical background noise level | High | Plant noise level below night-time local authority limit*,– no adverse impact |
| EP2 | 491-39 Chilton Grove | Night time noise levels not measured at this location | Plant noise emission to be designed to a rating level at receptor 5dB below the typical background | High | Plant noise level below night-time local authority limit*,– no adverse impact |

| Ref | Receptor | Lowest baseline noise level | Impact | Value/ sensitivity | Magnitude |
|---|---|---|---|---|---|
| | | | noise level | | |
| EP3 | 108-136 Chilton Grove | Night time noise levels not measured at this location | Plant noise emission to be designed to a rating level at receptor 5dB below the typical background noise level | High | Plant noise level below night-time local authority limit*,– no adverse impact |
| EP4 | 52-62 Croft Street | Night time noise levels not measured at this location | Plant noise emission to be designed to a rating level at receptor 5dB below the typical background noise level | High | Plant noise level below night-time local authority limit*,– no adverse impact |
| EP5 | Cannon Wharf block J | Night time noise levels not measured at this location | Plant noise emission to be designed to a rating level at receptor 5dB below the typical background noise level | High | Plant noise level below night-time local authority limit*,– no adverse impact |
| EP6 | Yeoman Street | Night time noise levels not measured at this location | Plant noise emission to be designed to a rating level at receptor 5dB below the typical background noise level | High | Plant noise level below night-time local authority limit*,– no adverse impact |

** Limit referred to is that identified for the Local Authority in which the receptor is located (see paras. 9.3.16 and 9.3.17)*

9.6.5 Background noise level measurements have not been undertaken for the night-time period at Earl Pumping Station as the site is not identified as requiring 24 hour continuous working. A noise survey would be completed before the installation of the equipment and these levels used to design the equipment to achieve the night-time local authority limit.

9.6.6 From the results given above in Vol 22 Table 9.6.1 and the statement in 9.6.5, no adverse impacts and the effects of plant noise at these emission levels is assessed as **not significant**. In the case of the residential receptor, this is based on compliance with the project requirement to prevent disturbance. For the non-residential receptors the noise levels are below ambient noise levels and therefore considered not to result in significant effects.

### Noise and vibration from tunnel filling

9.6.7 Measurements taken during storm and non-storm events at operational drop structures in the United States, equivalent to those being considered for the Thames Tideway Tunnel project, have been used to inform the assessment of noise and vibration during tunnel filling events. These studies (Jain *et al.*, 1983)[5], are described in Vol 2. The highest noise level measured on a mesh grille directly over a similar drop shaft, during this study, was 61dB$L_{Aeq}$ during a severe storm event.

9.6.8 These events are not typical and only occur during severe rain storms. At Earl Pumping Station, the drop shaft would be enclosed and any noise at the surface would be attenuated by the structure or the carbon filters and vent building. At the surface the noise level would be approximately 46dB$L_{Aeq,}$ which is comparable to the prevailing ambient noise level at this site.

9.6.9 The highest peak particle velocity (PPV) measured directly at the existing combined sewer overflow sites used in the case study as described in Vol 2 was 0.034mm/s. These measured PPV values are well below the levels for vibration to be just perceptible, according to the criterion given in Vol 2. Similarly, the levels are well below the transient and continuous vibration guideline criterion for building damage.

9.6.10 The noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and, in any case, is predicted to be not perceptible/ comparable to the existing ambient noise and vibration levels at the receptors. Therefore this is assessed as **not significant**.

### Operational maintenance

9.6.11 As part of the operation of the tunnel, there would need to be routine but infrequent maintenance carried out at the site. Two cranes would be required for ten yearly shaft inspections. This would be carried out during normal working hours, using equipment which is likely to increase ambient noise levels. Given the infrequency of this operation, it is considered that a significant noise effect would not occur.

9.6.12 Routine inspections, lasting approximately half a day, would occur every three to six months and would not require heavy plant. As this would be carried out during the daytime with minimal noisy equipment operating over short periods of time, it is considered that further assessment of noise generated by this activity is not required.

9.6.13 As no impacts have been identified from the operation of the site, this has been assessed as **not significant**.

### Noise from operational traffic

9.6.14 Additional traffic associated with operation of the site would be limited to vehicles used by maintenance and inspection workers. This is likely to be a number of light commercial vehicles used during routine inspection visits every three to six months and shaft inspections approximately every ten years.

9.6.15 As a proportion of the existing traffic on the road network these vehicles would not contribute to the traffic noise level and the noise effects of these movements are assessed as **not significant**.

### Sensitivity test for programme delay

9.6.16 For the assessment of noise and vibration effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors as the operational effects of the Thames Tideway Tunnel project are considered to be not significant. Based on the site development schedule (Vol 22 Appendix N), there would be no new receptors, within the assessment area, requiring assessment as a result of a one year delay.

## 9.7 Cumulative effects assessment

### Construction effects

9.7.1 Of the projects described in Section 9.3, the Cannon Wharf and Yeoman Street developments are considered relevant to the construction cumulative assessment at Earl Pumping Station as they are assumed to be under construction during the construction of the Thames Tideway Tunnel project. As such all the receptors around the site would be subject to elevated effects from cumulative construction noise from the Thames Tideway Tunnel project, Yeoman Street and Cannon Wharf developments. It is assessed that these effects would be **significant**.

9.7.2 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately one year, more of the Cannon Wharf and Yeoman Street developments may be built and occupied which would lead to a corresponding reduced level of cumulative activity. Cumulative effects would therefore be no greater than described above.

### Operational effects

9.7.3 None of the projects described in Section 9.3, are considered relevant to the operational cumulative assessment at Earl Pumping Station as due to their use they are not expected to generate significant noise or vibration levels during their operation. As such, no cumulative operational noise or vibration effects are identified. This would also be the case if the programme for the Thames Tideway Tunnel project was delayed by approximately one year.

## 9.8 Mitigation and compensation

### Construction

9.8.1 The above assessment has concluded that there are significant adverse noise effects during the construction phase at 1-39 Chilton Grove, 108-136 Chilton Grove, 52-62 Croft Street and Cannon Wharf Block J. However, no further on site noise mitigation can be adopted above those methods identified in the *CoCP*.

9.8.2 A *noise insulation and temporary re-housing policy* relating to construction disturbance from noise effects has been established (see Schedule 2 of the *Statement of Reasons,* which accompanies this application). The policy seeks to offset the potential adverse noise effects arising from construction and would be available to those residents where predicted or measured construction noise levels exceed trigger levels published in the policy. As there is no guarantee that the noise control measures would be accepted by the affected party, the two scenarios (with and without implementation of the policy) are presented in the residual effects section below.

9.8.3 The upper floors of 108 -136 Chilton Grove (which would not be screened by site hoarding) may be eligible for noise insulation as described in the policy. The most exposed properties at Cannon Wharf block J may also be eligible. This is a commonly used measure to control construction noise ingress to residential properties.

9.8.4 The effect of noise insulation on noise exposure inside the properties has been assessed in Section 9.9.

9.8.5 The noise levels predicted at 1-39 Chilton Grove and 52-62 Croft Street are rated as significant using the extended ABC and qualitative method (as discussed in Section 9.5 and Vol 2), however levels would not exceed the thresholds given in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* and as such these properties may not be eligible for noise insulation under this policy.

9.8.6 The residents of 1-39 Chilton Grove and 52-62 Croft Street may be eligible to apply for compensation through the *Thames Tideway Tunnel project compensation programme* (see Schedule 2 of the *Statement of Reasons,* which accompanies this application) which has been established to address claims of exceptional hardship or disturbance. The measures set out in the programme are not considered to be mitigation as there is no guarantee that the property in question would be eligible for compensation or that the compensation would be accepted by the affected party. Therefore residual effects reported in the *Environmental Statement* for these receptors do not take the offsetting effect of the compensation programme into account.

9.8.7 The above assessment has also concluded that there are also significant adverse construction vibration effects during the construction phase at 52-

62 Croft Street and Cannon Wharf block J. The use of low vibration piling methods where practicable is specified in *CoCP Part A*. As discussed in para. 9.5.52 it cannot be guaranteed that these measures can be implemented and as such significant adverse vibration effects are predicted. There are no further mitigation measures that can be adopted beyond these measures set out in the *CoCP* Part A and Part B (Sections 4 and 6).

9.8.8 The residents of 52-62 Croft Street and Cannon Wharf Block J may be eligible to apply for compensation through the *Thames Tideway Tunnel compensation programme* (see Schedule 2 of the *Statement of Reasons,* which accompanies this application) which has been established to address claims of exceptional hardship or disturbance. The measures set out in the programme are not considered to be mitigation as there is no guarantee that the property in question would be eligible for compensation or that the compensation would be accepted by the affected party. The residual effects reported in the *Environmental Statement* for these receptors do not take the offsetting effect of the compensation programme into account.

### Operation

9.8.9 The above assessment has concluded that there are not likely to be any significant adverse effects during the operational phase that would require mitigation.

### Operational effects

9.8.10 The above assessment has concluded that there are not likely to be any significant adverse effects during the operational phase that would require mitigation.

### Monitoring

9.8.11 Monitoring of construction noise would be carried out as described in the *CoCP* Part A and Part B (Sections 4 and 6). It is not anticipated that there would be any need for monitoring of operational noise.

## 9.9 Residual effects assessment

### Construction effects

#### Noise

##### 108 -136 Chilton Grove (EP3) and Cannon Wharf Block J (EP5)

9.9.1 The construction noise assessment set out above in Section 9.5 has identified significant effects at 108 -136 Chilton Grove and Cannon Wharf Block J.

9.9.2 The significant noise effects assessed at 108 -136 Chilton Grove and Cannon Wharf Block J could be addressed by noise insulation as set out in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* (see para. 9.8.2). It must be recognised, however, that the affected residents may not wish to take up the offer of noise insulation and thus the residual construction noise effects would remain as presented in Section 9.5.

9.9.3 If a noise insulation package as described in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* were installed, the internal daytime noise levels at 108 -136 Chilton Grove (unscreened upper floors) and Cannon Wharf Block J are estimated to reduce during the short period of worst-case noise levels to below the guidance criteria for living rooms. With the inclusion of a noise insulation package the construction noise effects would be rated as **not significant**.

#### 1-39 Chilton Grove (EP2) and 52-62 Croft Street (EP4)

9.9.4 As discussed at para. 9.8.5 the noise levels at 1-39 Chilton Grove and 52-62 Croft Street are rated as significant using the extended ABC and qualitative method (as discussed in Section 9.5 and Vol 2), however the levels would not exceed the thresholds given in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* and as such this property would not be eligible for noise insulation under this policy. Properties within 1-39 Chilton Grove and 52-62 Croft Street may, however, be eligible to apply for compensation under the *Thames Tideway Tunnel project compensation programme*. For the purpose of the assessment the residual effects reported in the *Environmental Statement* do not take the offsetting effects of the compensation programme into account and therefore the construction noise effects would remain as presented in Section 9.5.

### Vibration

9.9.5 Properties within Cannon Wharf Block J and 52-62 Croft Street may also be eligible for compensation for vibration effects under the *Thames Tideway Tunnel project compensation programme*. For the purpose of the assessment the residual effects reported in the *Environmental Statement* do not take the offsetting effects of the compensation programme into account. In addition, the use of low vibration piling methods where practicable would be used. However, it cannot be guaranteed that these measures could be implemented. Hence, the construction vibration effects would remain as presented in Section 9.5.

## Operational effects

9.9.6 As no mitigation measures are required, the residual operational effects remain as presented in Section 9.6.

## 9.10 Assessment summary

**Vol 22 Table 9.10.1 Noise – summary of construction assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| **Surface construction noise** | | | | |
| EP1 - 18-32 Yeoman Street | Noise | Not significant | None | Not significant |
| EP2 - 1-39 Chilton Grove | Noise | Significant | No further on site mitigation practicable | Significant, however properties may be eligible for compensation (see para. 9.9.4) |
| EP3 - 108-136 Chilton Grove | Noise | Significant | No further on site mitigation practicable | Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para 9.9.3. |
| EP4 - 52-62 Croft Street | Noise | Significant | No further on site mitigation practicable | Significant, however properties may be eligible for compensation (see para. 9.9.4) |
| EP5 - Cannon Wharf block J | Noise | Significant | No further on site mitigation practicable | Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para 9.9.3. |
| **Road-based construction traffic** | | | | |
| Residential and non-residential properties adjacent to the proposed vehicle route | Noise | Not significant | None | Not significant |

**Vol 22 Table 9.10.2 Vibration – summary of construction assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect | Comments |
|---|---|---|---|---|---|
| EP1 - 18-32 Yeoman Street | Vibration | Not significant | None | Not significant | |
| EP2 - 1-39 Chilton Grove | Vibration | Not significant | None | Not significant | |
| EP3 - 108-136 Chilton Grove | Vibration | Not significant | None | Not significant | |
| EP4 - 52-62 Croft Street | Vibration | Significant | No further on site mitigation practicable | Significant, however properties may be eligible for compensation (see para. 9.8.7) | As discussed in para. 9.5.52, successful implementation of low vibration piling as set out in the *CoCP* would reduce the effect to not significant. |
| EP5 - Cannon Wharf block J | Vibration | Significant | No further on site mitigation practicable | Significant, however properties may be eligible for compensation (see para. 9.8.7) | As discussed in para. 9.5.52, successful implementation of low vibration piling as set out in the *CoCP* would reduce the effect to not significant. |

**Vol 22 Table 9.10.3 Noise – summary of operational assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| EP1 - 18-32 Yeoman Street | Noise | Not significant | None | Not significant |
| EP2 - 1-39 Chilton Grove | Noise | Not significant | None | Not significant |
| EP3 - 108-136 Chilton Grove | Noise | Not significant | None | Not significant |
| EP4 - 52-62 Croft Street | Noise | Not significant | None | Not significant |
| EP5 - Cannon Wharf block J | Noise | Not significant | None | Not significant |
| EP6 - Yeoman Street | Noise | Not significant | None | Not significant |

**Vol 22 Table 9.10.4 Vibration – summary of operational assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| EP1 - 18-32 Yeoman Street | Vibration | Not significant | None | Not significant |
| EP2 - 1-39 Chilton Grove | Vibration | Not significant | None | Not significant |
| EP3 - 108-136 Chilton Grove | Vibration | Not significant | None | Not significant |
| EP4 - 52-62 Croft Street | Vibration | Not significant | None | Not significant |
| EP5 - Cannon Wharf block J | Vibration | Not significant | None | Not significant |
| EP6 - Yeoman Street | Vibration | Not significant | None | Not significant |

# References

[1] National Policy Statement for Waste Water (2012) Department of Environment, Food and Rural Affairs. http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf last accessed November 2012

[2] British Standards Institution, *BS 4142 Method for rating industrial noise affecting mixed residential and industrial areas* (1997)

[3] British Standards Institution, BS 5228 Code of Practice for Noise and Vibration Control on Open Construction Sites, British Standards Institution (2009)

[4] British Standards Institution, BS 8233 Code of Practice for Sound insulation and noise reduction for buildings, British Standards Institution (1999)

[5] Jain, SC and Kennedy, JF. *Vortex-Flow Drop Structures for the Milwaukee Metropolitan Sewerage District Inline Storage System*. Iowa Institute of Hydraulic Research. IIHR Report No 264 (Jul 1983)

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Thames Tideway Tunnel
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 10: Socio-economics

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

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January 2013

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Creating a cleaner, healthier River Thames

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 10: Socio-economics

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# 10 Socio-economics

## 10.1 Introduction

10.1.1 This section presents the findings of the assessment of the likely significant socio-economic effects of the proposed development at the Earl Pumping Station site. At this site effects during construction are considered on the businesses that currently exist on the proposed construction site and on the amenity of nearby residents.

10.1.2 Operational effects arising from a reduction in designated employment land were scoped in within the *Scoping Report*. However, as of June 2011, the land at the site is no longer designated under local planning policy as employment land. As such, no assessment is warranted. For this reason, no significant operational effects are considered likely and only information relating to construction is presented in the assessment of effects on socio-economics.

10.1.3 The likely significant project-wide socio-economic effects, including employment generation, stimulation of industry, and leisure and recreation related effects on users of the River Thames are described in Volume 3 Project-wide effects assessment.

10.1.4 The assessment of socio-economics presented in this section has considered the requirements of the National Policy Statement for Waste Water Sections 4.8 (land use) and 4.15 (socio-economic) (Defra, 2012)[1]. Further details of these requirements can be found in Volume 2 Environmental assessment methodology Section 10.3.

10.1.5 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

10.1.6 This assessment has drawn on the findings of the air quality and odour, noise and vibration and townscape and visual assessments (Sections 4, 9 and 11 respectively within this volume).

## 10.2 Proposed development relevant to socio-economics

10.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to socio-economics are set out below.

### Construction

10.2.2 Industrial and warehousing premises, that presently accommodate three businesses, would be demolished and their occupants relocated to allow for construction of the proposed development at this site.

10.2.3 Works at the site are expected to last approximately four years. See Section 3.3 of this volume for further details of the construction working hours.

10.2.4 Construction related activities, including traffic and lorry movements, could result in amenity effects (caused by air quality impacts, construction dust, noise, vibration, and visual impacts) being experienced by a range of sensitive socio-economic receptors in proximity to the proposed activities (refer to Volume 2 Environmental assessment methodology for further information on the amenity assessment methodology).

### Direct employment creation on site

10.2.5 The construction site is expected to require a maximum workforce of approximately 40 workers at any one time. The number and type of workers is shown in Vol 22 Table 10.2.1.

**Vol 22 Table 10.2.1 Socio-economics – construction worker numbers**

| Contractor | | Client |
|---|---|---|
| **Staff*** | **Labour**** | **Staff***** |
| **08:00-18:00** | **08:00-18:00** | **08:00-18:00** |
| 15 | 20 | 5 |

**Staff Contractor – engineering and support staff to direct and project manage the engineering work and site.*
***Labour – those working on site doing engineering, construction and manual work.*
**** Staff Client – engineering and support staff managing the project and supervising the Contractor.*

### Code of Construction Practice

10.2.6 Measures applicable to all sites incorporated into the *Code of Construction Practice (CoCP)*[i] *Part A* to limit significant adverse air quality (Section 7), noise, vibration (Section 6), and visual impacts (Section 4) would help to avoid socio-economic effects, particularly amenity effects.

10.2.7 The *CoCP Part A* confirms that all land, including highways, footpaths, public open spaces, river embankments / waterways, loading facilities or other land occupied temporarily would be made good to the satisfaction of Thames Water[ii] and the local authority where required. This would be in accordance with the *Ecology and landscape management plan* and the approved landscape design for the site (see Section 4 within the *CoCP Part A*).

10.2.8 The *CoCP Part B* confirms that the footway diversions on Croft Street and Yeoman Street are to be adequately signed and protected (see Section 5 within the *CoCP Part B*).

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[i] The Code of Construction Practice (CoCP) is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

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

10.2.9 Further site specific measures, which could reduce socio-economic effects and particularly amenity effects, are incorporated into the *CoCP Part B* (Section 4). See the *CoCP* sections in the air quality and odour, noise and vibration, and townscape and visual assessments (Sections 4.2, 9.2 and 11.2 respectively within this volume) for details on the type of measures that would be employed.

## 10.3 Assessment methodology

### Engagement

10.3.1 Vol 2 Section 10 of this assessment documents the overall engagement process which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of socio-economics are presented in Vol 22 Table 10.3.1.

**Vol 22 Table 10.3.1 Socio-economics – stakeholder engagement**

| Organisation | Comment | Response |
|---|---|---|
| London Borough (LB) of Lewisham, July and October 2012 (This comment was received twice, in response to two separate phases of consultation.) | Thames Water identify that 24 employees are likely to be displaced, based on a calculated estimate rather than an assessment of the actual businesses in the area. Further information is required regarding the actual effect on businesses and their employees and what proposals, if any, are proposed to compensate and relocate those businesses which are affected. | A more accurate estimate, based on liaison with the businesses, has been made. This has enabled the estimate to be revised down to a considerably lower number and this has been included within the baseline information provided within this assessment. Detail of the effects on the business have also been reconsidered and presented within this assessment. |
| Greater London Authority (including Transport for London), February, 2012 | Ensure that local businesses are suitably relocated. | A compensation programme (included within Schedule 2 of the *Statement of Reasons*, which accompanies the application) has been established which would provide for statutory compensation for those businesses that would need to relocate. Reasonable costs and expenditure incurred in association with the moves would be met by the project. An assessment |

| Organisation | Comment | Response |
|---|---|---|
| | | of the effects of relocation is included within this assessment (see Section 10.5). |
| LB of Southwark, October 2012 | There is a significant risk of impacts upon the residential properties in Southwark (from the development of Earl Pumping Station) given their location facing the north west and south west. | Consideration of effects on residents of surrounding properties is included in this socio-economic assessment (see Section 10.5).<br>Properties situated closest geographically to the proposed site have been assessed; therefore the assessment presents a reasonable 'worst case' scenario in terms of the effect on residential amenity. |

## Baseline

10.3.2 The baseline methodology follows the methodology described in Vol 2 Section 10.5. There are no site specific variations for identifying the baseline conditions for this site.

## Construction

10.3.3 For this site, the base case is the peak year of construction works. The assessment area is as set out in Vol 2 Section 10.5.

10.3.4 The assessment methodology for the construction phase follows that described in Vol 2 Section 10.5. There are no site specific variations for undertaking the construction assessment at this site.

10.3.5 Section 10.5 details the likely significant effects arising from the construction at Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on socio-economics within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

10.3.6 Of the developments listed in the site development schedule (see Vol 22 Appendix N), the following developments have been considered relevant in the construction assessment base case:

a. Cannon Wharf – located adjacent to the site and including residential floorspace and forming part of the Plough Way Strategic Site Allocation as allocated within LB of Lewisham Core Strategy (LB of Lewisham, 2011)[2]. Blocks B1, B2, B3, B4, C1, C2, C3, G, H, J and Business Centre would be complete and operational by the base case year, with the remainder of the development still under construction.

b. Tavern Quay – located 150m northeast of the site and including residential floorspace.

10.3.7 Both of these developments would be fully or partly complete and operational by the base case year, thereby increasing the number of residential receptors within 250m of the site that could be potentially sensitive to amenity effects arising as a result of construction at the Earl Pumping Station site. Other developments are not considered relevant as they would not directly affect the businesses that would be displaced or because they are located beyond the 250m assessment area used to screen potential receptors for the assessment of amenity effects.

10.3.8 Of the developments listed in the site development schedule (see Vol 22 Appendix N), the following developments have been considered in the construction effects cumulative assessment:

a. Marine Wharf West – located approximately 100m east of the site

b. Yeoman Street – located approximately 10m east of the site

c. Cannon Wharf – adjacent to the site. The remainder of the development, ie, blocks A, B5, C4, D1, D2, D3, E, F and the family accommodation, would be under construction in the base case year.

10.3.9 These developments would be under construction at the same time as the Thames Tideway Tunnel project and are located within the 250m amenity effect assessment area. Therefore, they could lead to cumulative amenity impacts on sensitive receptors.

## Assumptions and limitations

10.3.10 The generic assumptions and limitations associated with this assessment are presented in Vol 2 Section 10.5.

### Assumptions

10.3.11 It is assumed that:

a. the three businesses occupying the southern part of the proposed construction site do not depend intrinsically on their current location to carry out their business and that each business would be able to conduct its businesses from alternative premises. This assumption is based on knowledge of the nature of the businesses on the site and the distribution and off-site servicing related purposes for which these business premises are generally used.

b. although the proposed construction site has recently been redesignated from employment uses, the three businesses currently occupying the southern part of the proposed construction site would be there in the construction base case. See para. 10.4.18 for further detail.

### Limitations

10.3.12 There are no limitations specific to the assessment of this site.

# 10.4 Baseline conditions

## Current baseline

10.4.1 The following section sets out the baseline conditions for socio-economics within and around the site. Future baseline conditions (base case) are also described.

### Local context

10.4.2 The surrounding area within 250m of the site contains a mix of terraced housing, medium rise (four to six storeys in height) local authority built housing and recently built housing comprised mostly of flats of three to six storeys. There is also a mixture of functioning and derelict industrial and warehousing related uses located to the immediate south and east of the site, which are proposed to be redeveloped for residential-led mixed uses as part of the Plough Way Strategic Site Allocation (see Vol 22 Figure 2.1.2 in separate volume of figures). Parts of Greenland Dock and the South Dock Marina also lie just within 250m of the site, providing for a mix of housing and recreational related uses.

#### Community Profile

10.4.3 A detailed community profile is outlined in Vol 22 Appendix H.1[iii]. The following points provide a summary of the community profile and provide context for this socio-economic assessment:

a. Within 250m of the project site the resident population was 2,625 at the time of the last census for which data is available[iv].

b. The proportion of residents within 250m of the site under 16 and over 65 years old is lower than the average for both the LB of Lewisham and Greater London overall. Overall less than a quarter of residents within 250m fall into those two categories compared with almost one third of LB of Lewisham and Greater London residents.

c. Within 250m, White residents comprise approximately two thirds of the population. This proportion is broadly in line with the LB of Lewisham and slightly lower than for Greater London overall.

d. Black residents comprise 21.4% of the total proportion of residents within 250m. This is broadly in line with the proportion in LB of Lewisham (23.4%) but significantly higher than for Greater London (10.9%) as a whole.

e. Approximately 13% of residents within 250m have a long term or limiting illness, somewhat lower than within both the LB of Lewisham and Greater London. The proportion of residents who claim disability living allowance within 250m (5.9%) is slightly higher than within both the LB of Lewisham (5.2%) and Greater London (4.5%).

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[iii] Information sources are provided in the appendix.

[iv] Census 2001. This type of data for the 2011 Census had not been released at the time of the assessment.

f. General health is poor surrounding the site, with very high rates of adult obesity and average rates of child obesity relative to other Greater London boroughs. The rate of children undertaking physical activity at a borough wide level is very low relative to Greater London although the rate for adults undertaking physical exercise is average. Locally, death rates caused by major illnesses are very high relative to the average for all Greater London boroughs.

g. Male and female life expectancy is relatively low compared to Greater London.

h. The recorded incidence of income deprivation within 250m of the site is over four times that recorded for Greater London, whereas the proportion of car owners within 250m of the site is somewhat lower than across Greater London.

10.4.4 The community profile suggests that the local community is made up of predominantly White and Black residents, who generally experience poor health and low life expectancy. Local residents experience significantly higher than average levels of deprivation in comparison to the rest of the LB of Lewisham and Greater London.

### Economic profile

10.4.5 A local economic profile (based on 2012 data) is presented in Vol 22 Appendix H.2. The following points provide a summary of the profile and provide context to this socio-economic assessment:

a. Within approximately 250m of the site there are approximately 1,200 jobs and 270 businesses[v].

b. The three largest sectors as measured by employment within approximately 250m are: Professional, Scientific and Technical Activities; Administrative and Support Service Activities; and Accommodation and Food Service Activities.

c. The three largest sectors as measured by number of businesses at locations / units within approximately 250m are: Information and Communication; Wholesale and Retail Trade / Repair of Motor Vehicles and Motorcycles; and Administrative and Support Service Activities.

d. At all geographical levels more businesses fall within the micro size band (one to nine employees) with a slightly higher proportion of these recorded than for the LB of Lewisham and Greater London.

e. Businesses within the micro size band also account for the majority within each of the leading sectors within approximately 250m, with no

[v] Source: Experian 2012. Data is aggregated for seven digit post-code units falling wholly or partially within a 250m of the limits of land to be acquired or used (LLAU), including post code units on the opposite side of the River Thames if relevant. Employee data reflect a head count of workers on-site rather than Full Time Equivalent (FTE) jobs. The count of businesses relates to business ‘locations’ or ‘units’; an enterprise may have a number of business locations / units. Businesses as defined here include private sector, public sector and voluntary / charitable entities.

other business size band accounting for more than 10% of businesses in this geographical area.

### Receptors

#### Businesses – industrial and warehousing

10.4.6 The northern part of the site is occupied by a Thames Water owned pumping station. The southern part of the site is occupied by three businesses that use their respective premises at the site for warehousing / storage or distribution activities. The three businesses, and the number of employees understood to be permanently employed at each business, are:

a. A bottled water distribution depot; it is understood that the site is used as a distribution point and that no permanent employees are regularly stationed at the site although drivers would regularly call at the site to drop off and pick up stock.

b. A vehicle storage depot for a road haulage business, understood to employ approximately two people on site.

c. A vehicle storage depot for a mobile food takeaway business; understood to employ approximately three people on site and which services mobile food retail units at various sites including sites located at high profile positions in central London.

10.4.7 In total, it is understood that approximately five people are regularly employed at the three business premises at the site.

10.4.8 Vol 22 Figure 10.4.1 (see separate volume of figures) shows the location of this receptor.

10.4.9 The main factors affecting the sensitivity of the businesses to displacement of their activities are as follows:

a. It is considered that the nature of the activities taking place on site (which are not highly specialised or unique) is such that they could be replicated at other industrial and warehousing premises within LB of Lewisham or in the wider Greater London area.

b. In terms of available alternative premises, the LB of Lewisham *Employment Land Study (ELS)* (2008) indicated, based on Valuation Office Agency (VOA, 2012)[3] data, that 13% of the total industrial and warehousing floorspace in LB of Lewisham (542,000m$^2$) was vacant in 2006 (LB Lewisham, 2012)[4]. This level of vacancy compared with a rate of 6% in neighbouring LB of Greenwich, 9% in neighbouring LB of Southwark and 11% in Greater London in the same year. This is the latest date for which data at this spatial geography has been published.

c. Recent data from autumn 2011 for southeast London and Kent indicates that vacancy rates for such floorspace are approximately 7% as a whole (Glenny, 2011)[5], having increased by over 50% from 4.5% in spring 2007 (Glenny, 2011).

d. The gradual redevelopment of former industrial and employment land sites and precincts within central and south east London is likely to gradually reduce the average vacancy rates in this property market sector; although the state of the economy will also affect demand and supply for such sites.

10.4.10 On the basis of the factors considered above the sensitivity of the businesses to disruption or displacement of the facilities is considered to be medium.

### Residential

10.4.11 There are existing and base case residential developments near the proposed construction site as identified in the air quality, noise and vibration and townscape and visual assessments.

10.4.12 Land that is predominantly used for residential development is shown in the land use plan for this site, see Vol 22 Figure 2.1.2 (see separate volume of figures).

10.4.13 It is considered that the sensitivity of nearby residents to overall amenity effects would vary by time of day, with residents being somewhat less sensitive to amenity effects, particularly noise, during the day and more sensitive to such effects during the evening and night.

10.4.14 Therefore, as outlined in the methodology for this socio-economic impact assessment (see Vol 2 Section 10.5) the sensitivity of nearby residential receptors to amenity impacts would be medium during the day and high during the evening and night.

### Summary

10.4.15 A summary of receptors as described in the baseline and their sensitivity is provided in Vol 22 Table 10.4.1.

**Vol 22 Table 10.4.1 Socio-economics – receptor values / sensitivities**

| Receptor | Value / sensitivity and justification |
|---|---|
| Businesses | Medium – the vacancy rate for similar type floorspace within the local and adjacent property markets is moderate, indicating that there is a reasonable supply of alternative employment locations within LB of Lewisham or the southeast of London. The businesses are not highly dependent on their existing location given the nature of the activities they undertake from their premises. |
| Residents | Medium / High – residents would have limited opportunity to avoid effects. They would have medium sensitivity to amenity effects overall during the day but would have high sensitivity to amenity effects overall during the evening and night. |

## Construction base case

10.4.16 The construction assessment year and area are as set out in para. 10.3.3.

10.4.17 The base case in the peak year of construction, taking into account the schemes described in para. 10.3.6, would differ from baseline. It would include additional residential receptors that could potentially be affected by amenity impacts arising from the proposed development. These new residential receptors are identified in the air quality, noise and vibration and townscape and visual assessments.

10.4.18 None of the developments listed above directly affect the three businesses currently located at the site. However, the three businesses currently occupying the site are located on land that has been recently redesignated under the Plough Way Strategic Site Allocation for residential led mixed use redevelopment and many surrounding sites are scheduled for redevelopment in the near future. Therefore, it is considered that there is some probability that the businesses might vacate the site of their own accord in the base case (ie, even if it were not because of the proposed development). However for the purposes of this assessment, in case they do not vacate the site before the base case it is assumed that these three businesses would be present in the base case as they are in the existing baseline.

## 10.5 Construction effects assessment

### Displacement of businesses

10.5.1 The construction works would result in the displacement of the three businesses currently found at the site.

10.5.2 The magnitude of the impact is influenced by the following factors:

a. Although the construction is temporary, the displacement and impact for the business would most likely mean that once settled at new premises, the business would probably not choose to return to the existing site. This is considered likely for two reasons:

   i The deletion of the employment land use designation means that it is most likely that the site would be redeveloped in accordance with the land use objectives provided for by the local authority's Plough Way Strategic Site Allocation designation.

   ii Furthermore, operational structures would be located on part of the site and this would prevent reuse of that portion of the site for business activities of the sort existing in the baseline.

b. Alternative locations for the businesses have not yet been identified. Accordingly, it is not possible to take the new location of the businesses into consideration in this assessment.

c. Based on the activities taking place on site, it is assumed that the three businesses do not depend intrinsically on their location at this site to attract business and would be able to 'carry' their customers with them to a new location within the LB of Lewisham or the southeast region of London.

d. The three businesses are micro size enterprises based on the number of employees that they are estimated to employ on site.

e. The effect on the businesses of relocating could be potentially significant as there would be costs and expenditure associated with relocating including but not limited to removal expenses, legal and surveyor fees, taxes, costs of securing and adapting new premises, temporary loss of profits during the period of the move, and diminution of goodwill following the move. If the businesses became extinguished as a result of the relocation, their employees could potentially lose their jobs.

f. However, in accordance with the Thames Tideway Tunnel Compensation Programme (included within Schedule 2 of the *Statement of Reasons*, which accompanies the application), compensation would be available. Given that Thames Water would comply with the provisions of the programme, it is assumed for the purposes of this assessment that reasonable costs and expenditure incurred in association with relocation would be met.

10.5.3 There is a possibility that, despite the availability of statutory compensation, the requirement to relocate could result in the extinguishment of the business because it would not be economically viable for them to relocate. However, this assessment has considered that this scenario is unlikely.

10.5.4 Taking account of the above, it is considered that the businesses requiring relocation would relocate to new locations and continue to operate. Therefore, it is assessed that the magnitude of the impact arising from the relocation of the businesses to new locations would be low.

10.5.5 Given the low magnitude of the impact and the medium sensitivity of the receptor, it is assessed that there would be a **minor adverse** effect on the businesses and the associated employment arising from the displacement of the businesses at this site**.**

### Effect on the amenity of residents

10.5.6 Assessments have been undertaken to examine the likelihood of significant air quality, construction dust, noise, vibration, and visual effects of the project arising during construction. For further information, refer to the respective construction effects sections within this volume (Section 4 Air quality and odour, Section 9 Noise and vibration, and Section 11 Townscape and visual). The following points summarise the residual effect findings of those assessments in relation to nearby residential receptors:

a. Local air quality effects from construction road traffic and plant emissions would be **minor adverse** at four (Cannon Wharf, Chilton Grove, Croft Street and Yeoman Street) of the six residential receptors identified and **negligible** at the remaining two receptors. Local air quality effects from excavation of contaminated land would be **negligible** at all six receptors. Construction dust effects would be **minor adverse** at three receptors (Cannon Wharf, Chilton Grove, and Croft Street) and **negligible** at the remaining three.

b. Noise effects would be **significant** at four (1-39 Chilton Grove, 108-136 Chilton Grove, 52-62 Croft Street, and Cannon Wharf block J)[vi] of the five residential receptors identified and **not significant** at the remaining receptor. This finding is informed in part by the estimate that construction noise levels would exceed the potential significance criteria at 1-39 Chilton Grove and 108-136 Chilton Grove during the day for 48 months (ie, the total construction period), at 52-62 Croft Street during the day for 13 months and at Cannon Wharf block J during the day for 19 months and during the evening for one month. There would not be any other exceedances during the evening or night. Noise effects from road-based construction traffic would be **not significant**. Vibration (human response) effects would be **significant** at two of the five residential receptors identified (52-62 Croft Street and Cannon Wharf block J)[vii] and **not significant** at the three remaining receptors.

c. Visual effects are likely to be **moderate adverse** at three viewpoints (viewpoints 1.1, 1.6 and 1.8), **minor adverse** at three further viewpoints (viewpoint 1.7, 1.9 and 1.10) and **negligible** at the remaining four viewpoints (viewpoints 1.2, 1.3, 1.4 and 1.5).

10.5.7 In assessing the overall magnitude of impact, the above findings have been taken into consideration together with the following factors that are relevant to the overall experience of amenity at this site:

a. Given the approximate four year construction programme, the effects noted above would be likely to be experienced over a medium term period. The exception is that local air quality effects may not be minor adverse over the whole construction period as the assessment is purely based on the peak construction year and these effects may be negligible in other years.

b. While it is estimated that there would be moderate adverse visual effects at three viewpoints, it is considered that views from a residential property form one of many elements that contribute to the quality of a residential environment. Many of the dwellings at the receptors represented by this viewpoint are also likely to have views in other directions that are either not as severely affected or not affected at all.

c. Whilst noise effects on four receptors would be significant, these effects would mostly take place during the day rather than during the evening or night. As such, they would be less likely to substantially reduce residential amenity than if they were occurring during the evening and night time.

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[vi] The noise and vibration assessment reports that the residual effects for 108-136 Chilton Grove and Cannon Wharf block J are considered significant, however properties may be eligible for a noise insulation package, which if accepted, would reduce the effect to not significant for both these receptors (see Vol 22 Section 9.9).

[vii] The noise and vibration assessment reports that the residual vibration effect for 52-62 Croft Street and Cannons Wharf block J is considered not significant subject to successful implementation of low vibration piling as set out in the *CoCP* (see Vol 22 Section 9.9).

d. It is noted that in light of the commercial and industrial nature of the site, the amenity experience of users would not be dramatically changed from the base case. It is also noted that the noise assessment found that the additional numbers of HGVs in local streets would not cause any change to the traffic noise levels.

10.5.8 Taking account of the above factors, it is considered that the overall amenity impact magnitude would be medium.

10.5.9 Given the medium impact magnitude and the medium sensitivity, it is considered that the effect on the amenity of a limited number of residential receptors would be **moderate adverse**.

10.5.10 This assessment relates primarily to those residential receptors that would experience adverse local air quality, construction dust, noise, vibration and visual effects. For residential receptors not subject to all of these effects, it is considered that there would be a lower effect on their amenity. For residential receptors not subject to any of these effects, it is considered that there would be a negligible effect on their amenity.

## 10.6 Operational effects assessment

10.6.1 Operational effects for socio-economics for this site have not been assessed (see para. 10.1.1).

## 10.7 Cumulative effects assessment

10.7.1 For the purposes of this cumulative assessment, the assessment year is the peak construction year.

10.7.2 Of the projects described in Section 10.3, there are three projects, Marine Wharf West, Yeoman Street, and Cannon Wharf, which would be under construction in the peak year of construction at this site.

10.7.3 In respect of the assessments undertaken in Section 10.5 concerning the displacement of the three businesses, as these developments are not located on or within the proposed project site, it would not be possible for them to give rise to cumulative effects. Therefore the effects on socio-economics, in respect of the businesses, would remain as described in Section 10.5 above.

10.7.4 In respect of the amenity effect assessments undertaken in Section 10.5, the developments are located within the assessment area for amenity effects and so they could give rise to cumulative effects on the amenity of potentially sensitive residential receptors.

10.7.5 The air quality and construction dust cumulative effect assessments (see Section 4.7 of this volume) have confirmed that effects on receptors would remain as described in Section 4.5. The noise and vibration cumulative effect assessment (see Section 9 of this volume) concluded that all the receptors around the site would be subject to elevated effects from cumulative construction noise from the Thames Tideway Tunnel project, Cannon Wharf and Yeoman Street developments and that there is potential for these elevated effects to be significant. The townscape and visual cumulative effect assessment (see Section 11 of this volume) concluded that construction activity associated with all of the three projects would result in significant effects on five visual assessment viewpoints during construction (viewpoints 1.2, 1.4, 1.7, 1.9, and 1.10) and would result in elevated effects on viewpoints 1.3 and 1.5.

10.7.6 Having had regard to these assessments, it is considered that there would be elevated amenity effects on the residential receptors and that there is potential for these elevated effects to be significant.

## 10.8 Mitigation and compensation

### Mitigation

#### Construction

10.8.1 The above assessment has concluded that there is a potential for a significant adverse effect on the amenity of some nearby residents.

10.8.2 The above amenity assessment has drawn from the residual effects assessments undertaken in relation to air quality, construction dust, noise, vibration (human response) and visual effects. This means that where practicable and applicable, embedded measures have already been included within the scheme, and that no further practicable measures can be adopted above those methods identified in the *CoCP*.

10.8.3 The above assessment has concluded that there would be no other major or moderate adverse socio-economic effects at the site requiring additional mitigation.

### Compensation

#### Construction

10.8.4 A compensation programme has been established (included within Schedule 2 of the *Statement of Reasons*, which accompanies the application) relating to construction disturbance - for example, noise, dust, vibration, and / or light disturbance from worksites at night. The programme has been established to address claims of exceptional hardship or disturbance.

10.8.5 In relation to the effects on residential amenity, the programme measures are not considered to be mitigation as there is no guarantee that the properties in question would be eligible for compensation or that the compensation would be accepted by the affected party. The residual effects reported in this *Environmental Statement* do not therefore take the offsetting effects of these measures into account. Further information is contained in the Thames Tideway Tunnel Compensation Programme (see Schedule 2 of the *Statement of Reasons* which accompanies the application).

## 10.9 Residual effects assessment

10.9.1 As no mitigation for amenity effects is practicable beyond the measures included within the *CoCP*, and as compensation only offsets rather than mitigates (ie, reduces) a significant adverse effect, the amenity effects on some nearby residents would remain as described in Section 10.5.

10.9.2 All residual effects are presented in Section 10.10.

## 10.10 Assessment summary

**Vol 22 Table 10.10.1 Socio-economics – summary of construction assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect | Compensation |
|---|---|---|---|---|---|
| Businesses | Displacement of businesses | Minor adverse | None | Minor adverse | |
| Residents | Effect on the amenity of some residents (see para. 10.5.6 to para. 10.5.10 for detail) | Moderate adverse | No further on site mitigation practicable | Moderate adverse | Compensation mechanisms available for amenity related disturbance during the construction phase |

# References

[1] Department of Environment, Food and Rural Affairs. *National Policy Statement for Waste Water* (2012). Available from: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf Accessed November 2012.

[2] LB of Lewisham. *Lewisham Core Strategy Development Plan Document,* p.152. (2011).

[3] Valuation Office Agency. *Commercial and Industrial Property Vacancy Statistics.* Available at: http://www.neighbourhood.statistics.gov.uk/. Accessed 5th March 2012.

[4] LB Lewisham. *LB Lewisham Employment Land Study* (Nov 2008). Available at: http://www.lewisham.gov.uk/myservices/planning/policy/LDF/evidence-base/Pages/LDF-evidence-base-employment-and-retail.aspx. Accessed 5th March 2012.

[5] Glenny. *Glenny Databook: Essential Market Data Quarter 3 2011*. Available at: http://www.glenny.co.uk/default.aspx?mId=52 Accessed 5th March 2012.

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**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 11: Townscape and visual

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

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 11: Townscape and visual

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# 11 Townscape and visual

## 11.1 Introduction

11.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on townscape and visual amenity at the Earl Pumping Station. The assessment describes the current conditions found within and around the site – the nature and pattern of buildings, streets, open space and vegetation and their interrelationships within the built environment – and the changes that would be introduced as a result of the proposed development during construction and operation.

11.1.2 The effects of these changes during construction and operation are assessed. The assessment includes effects on townscape character areas and visual effects during daytime for the peak construction year, and Year 1 and Year 15 of operation. The assessment also identifies mitigation measures where appropriate.

11.1.3 Effects arising from lighting during the construction and operational phases have not been assessed. This is on the basis that there would not be any significant effects (this is further explained in para. 11.3.9 for construction and para. 11.3.18 for operation).

11.1.4 Each section of the assessment is structured so that townscape aspects are described first, followed by visual.

11.1.5 The assessment of the likely significant townscape and visual effects of the project has considered the requirements of the National Policy Statement (NPS) for Waste Water (Defra, 2012)[1]. In line with these requirements, the townscape and visual assessment considers effects during construction and operation on townscape components, townscape character and visual receptors. The construction and design of the proposed development also takes account of townscape and visual considerations in line with the NPS recommendations. Vol 2 Section 11 provides further details on the methodology.

11.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

## 11.2 Proposed development relevant to townscape and visual

11.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to the townscape and visual assessment are set out below.

### Construction

11.2.2 The specific construction works which may give rise to effects on townscape character and visual receptors are listed as follows, with the activities likely to give rise to the most substantial townscape and visual effects described first:

a. demolition of existing buildings and structures

b. use of cranes during shaft sinking and secondary lining of the shaft

c. provision of welfare facilities, assumed to be a maximum of three storeys in height

d. installation of 2.4m high hoardings around the boundary of the construction site and 3.6m high hoardings adjacent to Croft Street

e. vehicular access to the site off Yeoman Street, and out of the site onto Croft Street

f. selective pruning of existing trees to the west of the existing pumping station adjacent to Croft St.

### Code of Construction Practice

11.2.3 Measures incorporated into the *Code of Construction Practice* (CoCP)[i] *Part A* to reduce townscape and visual impacts include:

a. protection of existing trees in accordance with *BS5837 'Trees in Relation to Construction – Recommendations'* (Section 11)

b. installation of well-designed visually attractive hoardings (Section 4)

c. the use of appropriate capped and directional lighting when required (Section 4).

11.2.4 Measures incorporated into the *CoCP Part B* (Section 4)include:

a. provision for incorporating suitable art work on public facing sections of hoarding

b. use of 3.6m high hoardings adjacent to 62 Croft Street.

## Operation

11.2.5 The particular components of importance to this topic include the:

a. design, siting and materials used for the shaft which protrudes above ground at this location

b. design, siting and materials used for the ventilation columns and control kiosks, and the zones within which these above ground structures may be located.

### Environmental design measures

11.2.6 Figures illustrating the proposed development during operation are contained in a separate volume (see separate volume of figures – Section 1). Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint in Section 11.6.

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[i] The *Code of Construction Practice (CoCP)* is provided in Vol 1 Appendix A. It contains general requirements (*Part A*), and site specific requirements for this site (*Part B*).

11.2.7 Measures which have been incorporated into the design of the proposed development include (see the Site works parameter plan in separate volume of figures – Section 1 and *Design Principles* report in Vol 1 Appendix B):

a. a high quality, low maintenance roof, designed to be visually attractive when viewed from above, would be incorporated on top of the shaft

b. the design of the shaft enclosure would be designed to give visual interest to the surrounding streetscape and from above (PLM1X.6)

c. the ventilation columns (with the exception of the ventilation structure adjacent to the shaft), and electrical and control kiosk would be located within the pumping station.

## 11.3 Assessment methodology

### Engagement

11.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of townscape and visual effects are presented here.

11.3.2 Following the scoping process, the London Borough (LB) of Lewisham, neighbouring authority the LB of Southwark and English Heritage have been consulted on the detailed approach to the townscape and visual assessment, including the number and location of viewpoints. Comments received from the LB of Lewisham (March 2011) have been incorporated into the viewpoints used for the visual assessment, including adding new locations and amending the locations of others. English Heritage (May 2011) have confirmed acceptance of the proposed viewpoints. The LB of Southwark has not commented on the proposed viewpoints.

11.3.3 The stakeholders were also consulted on proposed changes to the viewpoints following the preliminary assessment findings, including removing some viewpoints from the operational assessment. The LB of Lewisham requested that viewpoints 1.1, 1.9 and 2.1 be included in the operational assessment, which are reflected in Section 11.6. The LB of Southwark and English Heritage have not commented on the proposed changes.

11.3.4 A description of how the on-site alternatives to the proposed approach have been considered and the main reasons why these alternatives have not been adopted is included in Section 3.6 of this volume.

### Baseline

11.3.5 The baseline methodology follows the methodology described in Vol 2 Section 11. In summary the following surveys have been undertaken to establish baseline data for this assessment:

a. Preliminary site visit to check the zone of theoretical visibility (ZTV), establish the extents of townscape character areas and identify locations for visual assessment viewpoints (September 2010)

b. Photographic survey of townscape character areas (August 2011)

c. Winter photographic surveys of the view from each visual assessment viewpoint (December 2011 and February 2012)

d. Summer photographic survey of the view from visual assessment viewpoints considered in the operational assessment (August 2011)

e. Verifiable photography (March 2011) and verifiable surveying (March 2011) for the viewpoint requiring a photomontage to be produced, as agreed with the stakeholders (described in para. 11.3.2).

11.3.6 With specific reference to the Earl Pumping Station site, baseline information on open space distribution and type and townscape character has been gathered through a review of:

a. The *Core Strategy for the LB of Lewisham* (LB of Lewisham, 2011)[2]

b. The *Core Strategy for the LB of Southwark* (LB of Southwark, 2011)[3].

## Construction

11.3.7 The assessment methodology for the construction phase follows that described in Vol 2 Section 11. Site specific variations are described below.

11.3.8 With reference to the Earl Pumping Station site, the peak construction phase relevant to this topic would be during Site Year 1 of construction, when the shaft would be under construction. Cranes would be present at the site and material would be taken away by road. This has therefore been used as the assessment year for townscape and visual impacts. The intensity of construction activities would be similar during Site Year 3 of construction, during the secondary lining of the tunnel, involving the import of materials by road.

11.3.9 No assessment of effects on night time character is made for this site during construction on the basis that:

a. the site would generally only be lit in the early evening during winter, except for short durations of extended working during major concrete pours

b. all site lighting would have minimal spill into the wider area due to the measures set out in the *CoCP Part A* and *Part B* (Section 11)

c. the surrounding area is lit in the early evening by street lighting and by light spill from surrounding buildings

d. visual receptors have limited sensitivity to additional lighting in the early evening.

11.3.10 The assessment area, defined using the methodology provided in Vol 2 Section 11, is indicated in Vol 22 Figure 11.4.5 for townscape and Vol 22 Figure 11.4.6 for visual (see separate volume of figures). The scale of the townscape assessment area has been set by the maximum extents of all character areas located partially or entirely within the construction phase ZTV, except in those locations along specific corridors to the north, east and south of the site where the construction works would be barely perceptible in the wider urban context. The scale of the visual assessment area has been set by the maximum extents of the construction phase ZTV, except in those locations along specific corridors to the north, east and south of the site where the construction works would be barely perceptible in the wider urban context. All visual assessment viewpoints are located within the ZTV.

11.3.11 Section 11.5 details the likely significant effects arising from the construction at Earl Pumping Station. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on townscape and visual receptors within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are included in this assessment.

11.3.12 For the construction base case for the assessment of effects arising from the proposed development at the Earl Pumping Station site, it is assumed that the following developments (identified within the site development schedule in Vol 22 Appendix N) within the assessment area would be complete and occupied by Site Year 1 of construction:

a. Blocks B1, B2, B3, B4, C1, C2, C3, G, H, J and the Business Centre of the Cannon Wharf mixed use development (including buildings up to 23 storeys), adjacent to the site.

11.3.13 For the purposes of the cumulative effects assessment, it is assumed that the following developments would be under construction during Site Year 1 of construction at the Earl Pumping Station site:

a. Yeoman Street five storey residential development, 10m east of the site

b. Marine Wharf West residential led mixed use development (comprising 1-8 storey buildings), 100m east of the site

c. Blocks A, B5, C4, D1, D2, D3, E, F and Family Accommodation of the Cannon Wharf development, adjacent to the site

11.3.14 All other schemes in the site development schedule (Vol 22 Appendix N) fall outside the townscape and visual assessment area so are not considered in the base case or cumulative assessment.

11.3.15 The assessment of construction effects also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

## Operation

11.3.16 The assessment methodology for the operational phase follows that described in Vol 2 Section 11. Any site specific variations are described below.

11.3.17 One verifiable photomontage has been prepared for this site to assist the assessment of operational effects. This is shown on Permanent works layout plan (see separate volume of figures – Section 1).

11.3.18 The operational phase assessment has been undertaken for Year 1 of operation and Year 15 of operation. The operation of the proposed development would have no operational or public realm lighting. Therefore, no assessment of effects on night time character is made for this site during operation.

11.3.19 The assessment area, defined using the methodology provided in Vol 2 Section 11, is indicated in Vol 22 Figure 11.4.5 for townscape and Vol 22 Figure 11.4.6 for visual (see separate volume of figures). The scale of the townscape assessment area has been set by the maximum extents of all character areas located partially or entirely within the operational phase ZTV. The scale of the visual assessment area has been set by the maximum extents of the operational phase ZTV. All visual assessment viewpoints are located within the ZTV.

11.3.20 Section 11.6 details the likely significant effects arising from the operation at Earl Pumping Station. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on townscape and visual receptors within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

11.3.21 In terms of the operational base case for the assessment of effects on Earl Pumping Station, it is assumed that the Marine Wharf West, Yeoman Street and Cannon Wharf developments (described in para. 11.3.12 and 11.3.13) would be complete and occupied by Year 1 of operation. It is assumed there would be no other substantial changes in the townscape and visual baseline within the assessment area for this site.

11.3.22 As detailed in the site development schedule (Vol 22 Appendix N) no schemes have been identified within 1km of the site which meet the criteria for inclusion in the cumulative assessment. Therefore no assessment of cumulative effects has been undertaken for effects on Earl Pumping Station in the operational phase.

11.3.23 As with construction (para. 11.3.15), the assessment of operational effects also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

## Assumptions and limitations

11.3.24 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 11. Site specific assumptions and limitations are detailed below.

### Assumptions

11.3.25 For the purposes of the construction phase assessment, it is assumed that the construction activities and plant, site hoardings, welfare facilities and access points are in the location shown on the construction phase 1 (site setup and shaft construction) plan. The assessment of effects would be no worse if these elements of the proposed development were in different locations within the maximum extent of working area shown on Construction phases plans (see separate volume of figures – Section 1), with the permanent structures under construction located within the zones shown on the Site works parameter plan (see separate volume of figures – Section 1).

11.3.26 For the purposes of the operational phase assessment, it is assumed that the above ground structures and areas of hardstanding are in the location shown on the landscape plan. The assessment of effects would be no worse if these elements of the proposed development were in different locations within the zones shown on the Site works parameter plan (see separate volume of figures – Section 1).

### Limitations

11.3.27 The assumed completion of one development in the construction phase base case and one in the operational phase base case would introduce additional visual receptors. Effects on these receptors are assessed in viewpoints 1.10 and 1.11 (paras. 11.3.12 and 11.3.21.). Due to suitable representative publicly accessible locations for viewpoints not being available at present, no photo has been included from these locations and the assessment has been undertaken based on professional judgement.

11.3.28 Despite the limitations identified above, the assessment is considered robust.

## 11.4 Baseline conditions

11.4.1 The following section sets out the baseline conditions for the townscape and visual assessment within and around the site as follows:

a. Information on the physical elements that make up the overall townscape character of the assessment area (topography, land use, development patterns, vegetation, open space and transport routes), which inform the identification of townscape character areas. These form the receptors for the townscape assessment.

b. Information on the townscape character (including setting), condition, tranquillity, value and sensitivity of the site and each townscape character area.

c. Information on the nature of the existing views towards the site at daytime from all visual assessment viewpoints, during both winter and summer where relevant. This is ordered beginning with the most sensitive receptors through to the least sensitive.

d. Future baseline conditions (base case) are also described.

### Current baseline

### Townscape baseline

#### Physical elements

11.4.2 The physical elements of the townscape in the assessment area are described below.

*Topography*

11.4.3 The assessment area is relatively flat with no notable topographic features within or around the site area.

*Land use*

11.4.4 The area to the north of the site is predominantly residential. To the east and south, the land use comprises a mix of commercial and light industrial workshops and warehouses with associated areas of hard standing. Beyond these commercial uses, the land use is again predominantly residential. The site is bounded to the west by Croft Street, which separates the site from a mix of commercial premises and residential properties, although the wider area is predominantly residential.

*Development patterns and scale*

11.4.5 Vol 22 Figure 11.4.1 (see separate volume of figures) illustrates the pattern and scale of development and buildings heights within the assessment area.

11.4.6 The surrounding residential areas are characterised by a mix of terraced two and three storey properties and larger four to six storey apartment blocks, particularly towards the north of the site. The residential properties are aligned along an informal network of roads, including a broad grid pattern to the west of the site. The residential properties have a mix of small front and rear gardens and communal grassed areas, some of which are enclosed by fencing.

11.4.7 The commercial and industrial areas are characterised by premises with both small and large footprints, low in height, set amongst areas of hard standing.

11.4.8 Much of the area is likely to be subject to future change as the LB of Lewisham is encouraging regeneration of the local area.

*Vegetation patterns and extents*

11.4.9 Vol 22 Figure 11.4.2 (see separate volume of figures) illustrates the pattern and extent of vegetation, including tree cover, within the assessment area.

11.4.10 Vegetation in the assessment area is predominantly mature and semi-mature street trees, although the industrial area to the east and south of the site has little of any vegetation type. The route of the former Surrey Canal and the disused Deptford Road Branch line railway form green corridors through the area, characterised by scattered trees and shrubs.

11.4.11 To the west of the site, Croft Street and Chilton Grove are characterised by mature street trees. Other vegetation is largely within private residential gardens.

11.4.12 With the exception of the disused canal and railway, which form green corridors, vegetation does not form an important element of the overall character.

11.4.13 There are no known Tree Preservation Orders (TPOs) within or in the vicinity of the assessment area.

*Open space distribution and type*

11.4.14 Vol 22 Figure 11.4.3 (see separate volume of figures) illustrates the distribution of different open space types within the assessment area, indicating all relevant statutory, non-statutory and local plan designations.

11.4.15 The Surrey Docks Adventure Playground forms the only main public open space in the assessment area. This, along with other semi-private open spaces are described in Vol 22 Table 11.4.1 below, ordered beginning with the closest open spaces to the site:

**Vol 22 Table 11.4.1 Townscape – open space type and distribution**

| Open space | Distance from site | Character summary |
|---|---|---|
| Plough Way communal green space | 30m north | Semi-private communal green space set between residential properties along Plough Way and Chilton Grove. The space is characterised by open amenity grassland with scattered trees and shrubs. |
| Surrey Canal and Rainsborough Avenue Embankments | 80m east | Linear private 1.3ha open space slightly elevated above ground level. The space is characterised by grassland with scattered trees and shrubs. |
| The Surrey Docks Adventure Playground | 250m northwest | Small public adventure playground surrounded by mature trees. |

*Transport routes*

11.4.16 Vol 22 Figure 11.4.4 (see separate volume of figures) illustrates the transport network within the assessment area, including cycleways, footpaths and Public Rights of Way.

11.4.17 The road network immediately around the site is residential in nature. Roadside parking and traffic calming is evident throughout the surrounding area, including along Chilton Grove and Croft Street, which lie adjacent to the site. The residential roads surrounding the site are not used extensively by heavy good vehicles (HGV).

11.4.18 There is a network of cycle routes in the wider area.

### Site character assessment

11.4.19 The site comprises an operational Thames Water pumping station and an adjacent area of commercial and industrial warehouses, including a two storey office building towards the south of the site. The existing pumping station has a frontage onto Chilton Grove, between Croft Street and Yeoman Street. The proposed CSO site is located to the southwest corner of the facility and is currently occupied by an area of hard-standing, adjacent to the existing pumping station facilities. There is no public access to this site.

11.4.20 The site is bounded in part by a red brick walling topped with metal railings and chainlink fencing, and in part by metal palisade fencing.

11.4.21 The site is dominated by industrial premises, structures and areas of hard standing. The character of the site is illustrated by Vol 22 Plate 11.4.1 and the components of the site are described in more detail in Vol 22 Table 11.4.2.

**Vol 22 Plate 11.4.1 The character of the site**

*Date taken: 18 August 2011. 50mm lens.*

**Vol 22 Table 11.4.2 Townscape – site components**

| ID | Component | Description | Condition |
|---|---|---|---|
| 01 | Earl Pumping Station building | Red brick single storey flat roofed building, with some architectural detailing along the façade. | Fair condition |
| 02 | Pumping station auxiliary buildings | Two red brick single storey rectangular buildings within the operational confines. | Good condition |
| 03 | Boundary walls and fence | Red brick boundary walls topped with metal railings, chainlink fencing and barbed wire. | Fair condition |
| 04 | Areas of hardstanding | Areas of asphalt and concrete paving surrounding the pumping station buildings. | Poor condition |
| 05 | Commercial/ industrial sheds | Warehouse buildings with associated hard-standing, metal palisade fencing and access onto Yeoman and Croft Streets. | Poor condition |

| ID | Component | Description | Condition |
|---|---|---|---|
| 06 | Mature street trees on Croft Street | Three mature London plane trees within the pavement of Croft Street. | Fair condition |

11.4.22 The condition of the townscape within the site is fair to poor, with many industrial buildings beyond the pumping station compound, in the southern part of the site, poorly maintained.

11.4.23 Although the site is largely open in character, with strong enclosures to the boundaries, the site has a low level of tranquillity due to the overlooking residential properties and existing industrial usage.

11.4.24 Due to its usage, the site has limited townscape value.

11.4.25 Due to its industrial character and the limited townscape value, the site has a low sensitivity to change.

### Townscape character assessment

11.4.26 There are two townscape character areas surrounding the site, Cannon Wharf Business Area townscape character area (TCA) to the east and south, and Rotherhithe Mixed Residential TCA to the west and north (identified in Vol 22 Figure 11.4.5, see separate volume of figures). Each area is described below.

*Cannon Wharf Business Area TCA*

11.4.27 This area is characterised by predominantly low rise commercial and industrial buildings set amongst areas of hardstanding. The area has little tree or vegetation cover, with the exception of two areas: scattered trees and shrubs along the line of the former Surrey Canal, which form a strong green corridor that dissects the area; and a substantial band of mature trees and vegetation along the southern boundary of the character area, following the embankment of the disused railway line. There are no public open spaces within the character area. The pattern of development is largely enclosed. The character of this area is illustrated by Vol 22 Plate 11.4.2.

**Vol 22 Plate 11.4.2  Cannon Wharf Business Area TCA**

*Date taken: 18 August 2011.  18mm lens.*

11.4.28 Tranquillity within the area is limited by the industrial use, the high levels of on and off street parking and the relative lack of public open space and vegetation.

11.4.29 The townscape has limited amenity value to the community due to the type of land use and the lack of public realm.

11.4.30 Due to the enclosed pattern of the development and the limited tranquillity of the area, that give it limited amenity value, it is considered that this character area has a low sensitivity to change.

*Rotherhithe Mixed Residential TCA*

11.4.31 This area comprises a diverse range of 20$^{th}$ century residential properties, including two and three storey terraced houses to four to six storey apartment blocks laid out broadly on a broad grid pattern.  The residential premises are interspersed with small private and semi-private green spaces and areas of hardstanding used for car parking.  Streets are characterised by street trees, some of which are mature and these create relatively shaded green corridors.  The character area is crossed by several main roads, including Plough Way (B206 passing east-west) and Lower Road (A200 passing north-south).  The northern edge of the character area follows the Cunard Walk footpath and cycleway.  The character of this area is illustrated by Vol 22 Plate 11.4.3.

**Vol 22 Plate 11.4.3 Rotherhithe Mixed Residential TCA**

*Date taken: 18 August 2011. 18mm lens.*

11.4.32 The area has moderate levels of tranquillity due to the residential land use, the presence of vegetation and limited volumes of traffic, apart from along the main roads, towards the edges of the character area.

11.4.33 The area is likely to be valued by local residents, by virtue of the abundance of street trees and the moderate levels of tranquillity, which provide a pleasant setting to the residential properties.

11.4.34 Due to the moderate level of tranquillity and residential character, strengthened by intermittent mature planting, this character area has a medium sensitivity to change.

### Visual baseline

11.4.35 Vol 22 Figure 11.4.6 (see separate volume of figures) indicates the location of viewpoints referenced below. All London View Management Framework London Panoramas, residential and recreational receptors have a high sensitivity to change. For each viewpoint, the first part of the baseline description relates to the view during winter, while the second part relates to the summer view for viewpoints included in the operational assessment.

#### London View Management Framework London Panoramas

*London Panorama 5A – Blackheath Point, Greenwich Park to St Paul's Cathedral*

11.4.36 This LVMF London Panorama passes through the northeast corner of the site and has a high sensitivity to change.

**Vol 22 Plate 11.4.4 London Panorama 5A: winter view**


*Date taken: 15 February 2012. 18mm lens.*

11.4.37 This protected viewing corridor passes through the northeast corner of the site. London Panoramas have a high sensitivity to change. The distant view (illustrated in Vol 22 Plate 11.4.4) towards St Paul's Cathedral is framed by vegetation and buildings within Greenwich Park, including the Greenwich Observatory. The site does not form a visible component within this viewing corridor.

### Residential

11.4.38 Residential receptors have a high sensitivity to change, as attention is often focused on the townscape surrounding the property rather than on another focused activity (as would be the case in predominantly employment or industrial areas). The visual baseline for residential receptors (represented by a series of viewpoints, agreed with consultees) is described below.

*Viewpoint 1.1: View south from residences along Yeoman Street*

11.4.39 This viewpoint is representative of the typical oblique view from residential properties along Yeoman Street north of the site.

**Vol 22 Plate 11.4.5 Viewpoint 1.1: winter view**

*Date taken: 20 December 2011. 18mm lens.*

11.4.40 The view (illustrated in Vol 22 Plate 11.4.5) is linear in nature along Yeoman Street and is framed by buildings and boundary fencing along Yeoman Street and Chilton Grove. The background of the view is characterised by commercial and industrial premises in Cannon Wharf Business Area. The northern extent of the site is visible in the frame of view, characterised by Earl Pumping Station and the boundary walling surrounding the compound.

*Viewpoint 1.2: View west from residences along Plough Way*

11.4.41 This viewpoint is representative of the typical view from residential apartments along Plough Way to the east of the site, close to Lighter Close.

**Vol 22 Plate 11.4.6  Viewpoint 1.2: winter view**


*Date taken: 20 December 2011.  18mm lens.*

11.4.42 The view (illustrated in Vol 22 Plate 11.4.6) from ground level is dominated by hoardings along the boundary of a neighbouring development site, which largely obscure views towards the site.  Views are further blocked by intervening industrial sheds immediately east of the site.  In contrast, views from the upper storeys of the residential apartments are likely to have direct unscreened views of the existing pumping station buildings.

*Viewpoint 1.3: View southwest from residences along Rope Street*

11.4.43 This viewpoint is representative of the typical view from residential apartments along Rope Street, at the northern edge of the South Dock.

**Vol 22 Plate 11.4.7 Viewpoint 1.3: winter view**

*Date taken: 20 December 2011. 35mm lens.*

11.4.44 The view (illustrated in Vol 22 Plate 11.4.7) is dominated by the roads, pavements and car parking surrounding the open expanse of water, framed by the residential buildings on the opposite side. Views towards the site are largely blocked by intervening buildings, although an open corridor provides glimpsed views towards the southern extent of the site.

*Viewpoint 1.4: View west from residences along Plough Way near Windsock Close*

11.4.45 This viewpoint is representative of the typical oblique view from residential properties along Plough Way to the east of the site, near Windsock Close.

**Vol 22 Plate 11.4.8 Viewpoint 1.4: winter view**

*Date taken: 20 December 2011. 18mm lens.*

11.4.46 The view (illustrated in Vol 22 Plate 11.4.8) is long and linear in nature along Plough Way, and is framed to the north by residential properties and to the south by commercial premises and areas of hardstanding (beyond boundary walling in the right of the image). Views towards the site are blocked by intervening buildings, although the southern extent is partially visible through some intervening vegetation.

*Viewpoint 1.5: View north from residences along Sapphire Road*

11.4.47 This viewpoint is representative of the typical oblique view from residential properties along Sapphire Road, close to the junction with Rainsborough Avenue.

**Vol 22 Plate 11.4.9 Viewpoint 1.5: winter view**

*Date taken: 20 December 2011. 18mm lens.*

11.4.48 From ground level, views (illustrated in Vol 22 Plate 11.4.9) are entirely blocked by the embankment of the disused railway and the vegetation along its length. From upper storeys, properties are likely to have wider intermittent views towards the site, partially screened by vegetation along the railway embankment. The background of these views is characterised by the industrial and commercial premises in Cannon Wharf Business Area.

*Viewpoint 1.6: View north from residences along Woodcroft Mews*

11.4.49 This viewpoint is representative of the typical oblique view from the rear windows and gardens of residential properties at the junction of Woodcroft Mews and Croft Street, close to the site boundary.

**Vol 22 Plate 11.4.10  Viewpoint 1.6: winter view**

*Date taken: 20 December 2011.  18mm lens.*

11.4.50 The view (illustrated in Vol 22 Plate 11.4.10) is linear in nature along Woodcroft Mews and is framed by buildings and mature street trees. Views towards the site are partially screened by the canopies of the trees.

**Vol 22 Plate 11.4.11  Viewpoint 1.6: summer view**

*Date taken: 18 August 2011. 18mm lens.*

11.4.51 In summer (illustrated in Vol 22 Plate 11.4.11), deciduous trees provide greater intermittent screening of the site, particularly from upper storeys.

*Viewpoint 1.7: View north from residences along Acacia Close*

11.4.52 This viewpoint is representative of the typical oblique view from residential properties in Acacia Close.

**Vol 22 Plate 11.4.12 Viewpoint 1.7: winter view**

*Date taken: 20 December 2011. 35mm lens.*

11.4.53 The foreground of the view (illustrated in Vol 22 Plate 11.4.12) is characterised by residential buildings within the close. Views towards the site are largely obscured by intervening buildings, metal palisade fencing and mature street trees along Croft Street and Woodcroft Mews.

**Vol 22 Plate 11.4.13 Viewpoint 1.7: summer view**

*Date taken: 18 August 2011. 35mm lens.*

11.4.54 In summer (illustrated in Vol 22 Plate 11.4.13), deciduous trees in the middle ground heavily screen views towards the site.

*Viewpoint 1.8: View northeast from residences at the junction of Acacia Close and Croft Street*

11.4.55 This viewpoint is representative of the direct view from residential properties at the junction of Acacia Close and Croft Street, close to the site boundary.

**Vol 22 Plate 11.4.14  Viewpoint 1.8: winter view**

*Date taken: 20 December 2011.  18mm lens.*

11.4.56 The foreground of the view (illustrated in Vol 22 Plate 11.4.14) is characterised by the mature London plane trees lining both sides of Croft Street and metal palisade fencing, which filter views towards the site.

**Vol 22 Plate 11.4.15  Viewpoint 1.8: summer view**

*Date taken: 18 August 2011.  18mm lens.*

11.4.57 In summer (illustrated in Vol 22 Plate 11.4.15), deciduous trees in the foreground heavily screen views towards the site.

*Viewpoint 1.9: View east from residences along Chilton Grove*

11.4.58 This viewpoint is representative of the typical oblique view from residential properties along Chilton Grove.

**Vol 22 Plate 11.4.16 Viewpoint 1.9: winter view**

*Date taken: 20 December 2011. 35mm lens.*

11.4.59 The foreground of the view (illustrated in Vol 22 Plate 11.4.16) is characterised by residential properties along the opposite side of Chilton Grove. The existing Earl Pumping Station building is visible at the end of the road and blocks views to the rest of the site from lower levels. However from the upper floors of the residential flats, the full site would be visible, set against the surrounding industrial and commercial area.

*Viewpoint 1.10: View north from newly built residences in the Cannon Wharf development (base case scheme)*

11.4.60 This viewpoint is representative of the typical oblique view for residents of new buildings (blocks G, H and J) in the Cannon Wharf development which are anticipated will be completed in advance of the proposed construction at Earl Pumping Station commencing (see para. 11.3.12). The view towards the site is characterised by residential buildings along Woodcroft Mews in the foreground, which largely obscure views of the site from ground level. Due to the viewpoint not being publicly accessible at present, no photo has been included from this location.

*Viewpoint 1.11: View west from newly built residences in the Yeoman Street development (base case scheme)*

11.4.61 This viewpoint is representative of the typical view for residents of the new residential block on Yeoman Street, which it assumed will be completed in advance of Year 1 of operation (see para. 11.3.21). The view towards the site at present comprises the Earl Pumping Station building and existing commercial buildings to the south. Due to the viewpoint not being publicly accessible at present, no photo has been included from this location.

### Recreational

11.4.62 Recreational receptors (apart from those engaged in active sports) have a high sensitivity to change, as attention is focused on enjoyment of the townscape. Tourists engaged in activities whereby attention is focused on the surrounding townscape also have a high sensitivity to change. The visual baseline in respect of recreational receptors, including tourists, is discussed below.

*Viewpoint 2.1: View from the footpath and open space between residences on Chilton Grove*

11.4.63 This viewpoint is representative of the typical view that a pedestrian would experience when walking towards the site, through the communal open space between residential apartments on Chilton Grove. The footpath connects Chilton Grove with Lower Road to the north.

**Vol 22 Plate 11.4.17 Viewpoint 2.1: winter view**

*Date taken: 20 December 2011. 18mm lens.*

11.4.64 The existing Earl Pumping Station building and boundary wall along the north of the compound are directly visible in the frame of view (illustrated in Vol 22 Plate 11.4.17). Mature trees border the view towards the site (on the right hand side of the image).

### Construction base case

11.4.65 The base case in Site Year 1 of construction taking into account the scheme described in para. 11.3.12 would change the character of Cannon Wharf Business Area TCA. By Site Year 1 of construction, the character of part this area would have been substantially altered by the assumed partial completion of the Cannon Wharf mixed use development, including blocks located immediately adjacent to the site. The redevelopment of a number of commercial and industrial premises into residential and mixed uses would alter the sensitivity of the character area from low to medium by Site Year 1 of construction.

11.4.66 In addition, the assumed completion of blocks G, H and J in the Cannon Wharf development would introduce additional residential visual receptors, represented by viewpoint 1.10.

11.4.67 All other receptors would remain as detailed in the baseline.

### Operational base case

11.4.68 The base case in Year 1 of operation taking into account the schemes described in para. 11.3.21 would further change the character of Cannon Wharf Business Area TCA. By Year 1 of operation, the character of the majority area would have been substantially altered by the assumed completion of all the developments listed in para. 11.3.21. However, it is not considered that this further redevelopment would alter the sensitivity of the character area beyond that described in para. 11.4.65 for the construction base case (medium).

11.4.69 In addition, the assumed completion of the Marine Wharf West and Cannon Wharf developments would further obscure views of the site from viewpoints 1.2, 1.3 and 1.4. The assumed completion of the Yeoman Street development to the east of the site would introduce additional visual receptors, represented by viewpoint 1.11.

11.4.70 All other receptors would remain as detailed in the baseline.

## 11.5 Construction effects assessment

11.5.1 The following section describes the likely significant effects arising from construction at Earl Pumping Station.

11.5.2 Due to the scale of the construction activities proposed across what are, in many cases, prominent locations in London, construction works would be highly visible. In policy terms, the NPS for waste water (Defra, 2012)[4] recognises that nationally significant infrastructure projects are likely to take place in mature urban environments, with adverse construction effects on townscape and visual receptors likely to arise. In addition, construction works are a commonplace feature across London, and therefore the following assessment should be viewed in this context. It should also be noted that construction effects are temporary in nature and relate to the peak construction year defined in Section 11.3. Effects during other phases of work are likely to be less due to fewer construction plant being required at the time and a reduced intensity of construction activity.

11.5.3 Illustrative plans of the possible layout of the site during construction are contained in a separate volume (see Construction phases plans in separate volume of figures – Section 1).

## Site character assessment

11.5.4 The existing Earl Pumping Station (components 01, 02 and 03 in Vol 22 Table 11.4.2) would remain operational throughout the construction phase, with the buildings all retained on the site.

11.5.5 Effects on the character of the site would arise from demolition of existing industrial buildings, boundary walls and fencing, general clearance of the site, creation of new access points from Yeoman Street and Croft Street, installation of site hoardings and welfare facilities, and construction activity associated with the construction of the shaft and secondary lining of the tunnel. The impacts on specific components of the site are described in Vol 22 Table 11.5.1.

**Vol 22 Table 11.5.1 Townscape – impacts on existing site components during construction**

| ID | Component | Impacts |
|---|---|---|
| 01 | Earl Pumping Station building | No change – building to remain operational throughout construction. |
| 02 | Pumping station auxiliary buildings | No change – buildings to remain operational throughout construction |
| 03 | Boundary walls and fence | No change to the northern boundary with Chilton Grove. New site access to be formed on the eastern and western boundaries of the site. Removal of the majority of the southern boundary to the neighbouring depot. |
| 04 | Areas of hardstanding | To be retained and made good or reinstated following the works. |
| 05 | Commercial/ industrial sheds | To be demolished. |
| 06 | Mature street trees on Croft Street | To be retained and protected. |

11.5.6 The low level of tranquillity at the site would be altered to a limited extent by the introduction of construction vehicles, plant equipment and high levels of activity in an area not currently intensively used.

11.5.7 Due to the clearance required to form the site and the level of activity, substantially affecting character and also affecting tranquillity to a limited extent, the magnitude of change is considered to be high.

11.5.8 The high magnitude of change, assessed alongside the low sensitivity of the site, would result in **minor adverse** effects.

## Townscape character areas assessment

### Cannon Wharf Business Area TCA

11.5.9 The proposed site forms part of the setting for the western edge of this character area. The setting along Yeoman Street would be affected by high levels of construction activity, including the presence of construction plant, welfare facilities, site hoardings, cranes and ongoing traffic movements. The setting would also be affected by the demolition of a number of existing commercial and industrial premises. However, the majority of this character area would remain largely unaffected and the magnitude of change would be further minimised by the existing industrial nature of the setting and the retention of the existing pumping station buildings.

11.5.10 The low levels of tranquillity in the area would be affected to a limited extent by construction activity at the site.

11.5.11 Due to the changes to the setting of this area in the vicinity of Yeoman Street only, and the limited changes to tranquillity, the magnitude of change is considered to be medium.

11.5.12 The medium magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

### Rotherhithe Mixed Residential TCA

11.5.13 The proposed site forms part of the setting for the eastern edge of this character area. The setting along Chilton Grove and Croft Street would be affected by high levels of construction activity, including the presence of construction plant, welfare facilities, site hoardings, cranes and ongoing traffic movements. The magnitude of change would be minimised by the existing industrial nature of the setting, and the retention of the existing pumping station buildings.

11.5.14 The moderate levels of tranquillity in the area would be affected to a limited extent by construction activity at the site.

11.5.15 Due to the changes to the setting of this area along Chilton Grove and Croft Street only, and the limited changes to tranquillity, the magnitude of change is considered to be medium.

11.5.16 The medium magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

### Townscape – sensitivity test for programme delay

11.5.17 For the assessment of townscape effects during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely materially to change the assessment findings reported above (paras. 11.5.4 to 11.5.16). The assessment area is subject to ongoing and long term change and a delay to the Thames Tideway Tunnel project is not likely to change the sensitivity to change of the townscape character areas already presented (paras. 11.4.2 to 11.4.34).

## Visual assessment

11.5.18 The visual assessment for the construction phase has been undertaken during winter, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in view, would be in leaf.

### London View Management Framework London Panoramas

#### London Panorama 5A – Blackheath Point, Greenwich Park to St Paul's Cathedral

11.5.19 During construction, cranes at the site would be barely perceptible within this panorama, viewed as an indistinct component of the middle ground of the view. Therefore, the magnitude of change to this London Panorama is considered to be negligible.

11.5.20 The negligible magnitude of change, assessed alongside the high sensitivity of the receptor, would result in a **negligible** effect.

### Residential

#### Viewpoint 1.1: View south from residences along Yeoman Street

11.5.21 The view towards the site at ground level would be characterised by a line of hoardings to the south side of Chilton Grove. Oblique views of the works from the upper storeys of residential properties on Yeoman Street would be partially obscured by the existing Earl Pumping Station building. Tall construction plant and cranes would be visible during construction of the shaft and secondary lining of the tunnel. Construction traffic would be intermittently visible passing along Yeoman Street and Chilton Grove. However, the foreground of the view, characterised by the existing pumping station building, would remain largely unchanged. Therefore, the magnitude of change is considered to be medium.

11.5.22 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

#### Viewpoint 1.2: View west from residences along Plough Way; Viewpoint 1.3: View southwest from residences along Rope Street; and Viewpoint 1.4: View west from residences along Plough Way near Windsock Close

11.5.23 Construction activity at the site would be almost entirely obscured by intervening buildings and vegetation. Tall construction plant and cranes would be intermittently visible above the surrounding buildings, although they would appear as indistinct components of the view. Therefore, the magnitude of change is considered to be negligible.

11.5.24 The negligible magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **negligible** effects.

#### Viewpoint 1.5: View north from residences along Sapphire Road

11.5.25 Due to the presence of the disused railway embankment in the foreground, from ground level this view would remain unchanged. Tall construction plant and cranes would be intermittently visible in the background of the view from upper storeys of the residential properties. Therefore, the magnitude of change is considered to be negligible.

11.5.26 The negligible magnitude of change, assessed alongside the high sensitivity of the receptor, would result in a **negligible** effect.

#### Viewpoint 1.6: View north from residences along Woodcroft Mews; and Viewpoint 1.8: View northeast from residences at the junction of Acacia Close and Croft Street

11.5.27 Oblique views from residences towards the site would be affected during construction. At ground level, the middle ground of the views would be characterised by site hoardings and intermittent construction traffic along Woodcroft Mews, partially screened by intervening buildings and mature street trees. Tall construction plant and cranes would be visible, partially screened by residential buildings adjacent to the site along Croft Street. Therefore, the magnitude of change is considered to be medium.

11.5.28 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **moderate adverse** effects.

#### Viewpoint 1.7: View north from residences along Acacia Close; and Viewpoint 1.10: View north from newly built residences in the Cannon Wharf development (base case scheme)

11.5.29 The foreground of the view towards the site from these locations would remain unchanged. The middle ground of the views would be characterised by site hoardings and construction traffic along Woodcroft Mews, although largely screened by intervening buildings and mature street trees. Tall construction plant and cranes would be intermittently visible in the background of the views. Therefore, the magnitude of change is considered to be low.

11.5.30 The low magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **minor adverse** effects.

#### Viewpoint 1.9: View east from residences along Chilton Grove

11.5.31 The view towards the site at ground level would be characterised by a line of hoardings to the south side of Chilton Grove. Oblique views of the works from the residential properties on Chilton Grove would be partially obscured by the existing Earl Pumping Station buildings. Tall construction plant and cranes would be intermittently visible. Construction traffic would be visible passing along Chilton Grove. Therefore, the magnitude of change is considered to be low.

11.5.32 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor adverse effects**.

### Recreational

#### Viewpoint 2.1: View from the footpath and open space between residences on Chilton Grove

11.5.33 The view towards the site at ground level would be characterised by a line of hoardings to the south side of Chilton Grove. Views of construction activity would be partially obscured by the existing Earl Pumping Station building. Tall construction plant and cranes would be visible above the roof line. Construction traffic would be intermittently visible passing along Yeoman Street and Chilton Grove. Therefore, the magnitude of change is considered to be medium.

11.5.34 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

### Visual effects – sensitivity test for programme delay

11.5.35 Para. 11.3.13 describes other developments assumed to be under construction at the same time as construction would be taking place at the Earl Pumping Station site. These are assessed cumulatively (Section 11.7). In the event that there is a programme delay of one year of the Thames Tideway Tunnel project, and assuming no change in the assumed rate of progress of the other developments, this would result in a re-categorisation of the Yeoman Street and Marine Wharf West developments, and further phases of the Cannon Wharf development from the cumulative assessment into base case. The increase in the number of visual receptors at the Cannon Wharf development would be already considered by viewpoint 1.10. However, the delay would introduce additional visual receptors with a view of the proposed development during construction, which would need to be represented by additional viewpoints.

## 11.6 Operational effects assessment

11.6.1 The following section describes the likely significant effects arising during the operational phase at Earl Pumping Station.

11.6.2 Effect on tranquillity is one factor which informs the overall assessment of effects on townscape character. Since the operation of the proposed development would have little above-ground activity associated with it, apart from infrequent maintenance visits, it is considered that the proposed development would have a negligible effect on tranquillity for all townscape character areas. This conclusion is not repeated for each character area discussed below.

11.6.3 Illustrative plans of the proposed development during operation are contained in a separate volume (see separate volume of figures – Section 1) and design principles describing the environmental design measures are set out in Vol 1 Appendix B. Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint below.

### Operational effects Year 1

#### Site character assessment

11.6.4 The proposed development would have a permanent effect on the character of the site. Within the confines of the existing Earl Pumping Station, a 4m high valve chamber, a 4-8m high ventilation column and two 6m high narrow ventilation columns would be introduced, whilst the remainder of the area would be reinstated as existing. The shaft, which would protrude above ground by 5m, would form an extension to the Earl

Pumping Station compound. The ventilation structure (5-7m high) would be sited adjacent to the shaft. The shaft would be surrounded by an area of hardstanding to provide crane access for maintenance. The section of the shaft which would protrude above ground would be finished to a high quality, as described in para. 11.2.6, with a finish designed to provide visual interest when viewed from the surrounding streetscape. The remainder of the area to the south of the Earl Pumping Station compound would be left as a cleared future development site by the Thames Tideway Tunnel project, surrounded by high quality hoardings. The impacts on specific components of the site are described in Vol 22 Table 11.6.1.

**Vol 22 Table 11.6.1 Townscape – impacts on baseline components in Year 1 of operation**

| ID | Component | Impacts |
|---|---|---|
| 01 | Earl Pumping Station building | No change – to remain operational. |
| 02 | Pumping station auxiliary buildings | No change – to remain operational. |
| 03 | Boundary walls and fence | No change to the northern boundary with Chilton Grove. Boundary walls and fences to the eastern, southern and western boundaries reinstated, incorporating the new shaft. |
| 04 | Areas of hardstanding | Left cleared and hoarded off for future development by others |
| 05 | Commercial/ industrial sheds | Removed during construction and left as a hoarded off future development site, apart from the area required for the shaft. |
| 06 | Mature street trees on Croft Street | Retained and protected to ensure minimal risk of health impacts to the growth of the trees. |

11.6.5 The magnitude of change is considered to be medium due to the substantial clearance of existing poorly maintained commercial and industrial premises and the introduction of new structures, broadly typical of the character of the existing pumping station.

11.6.6 Due to this clearance of dilapidated buildings and the high quality design of the shaft structure, the medium magnitude of change, assessed alongside the low sensitivity of the site, would result in **minor beneficial** effects.

### Townscape character areas assessment

#### Cannon Wharf Business Area TCA; and Rotherhithe Mixed Residential TCA

11.6.7 The proposed development would result in the addition of new and permanent above ground structures within, and on the periphery of the existing Earl Pumping Station boundary. The proposed shaft would replace existing poorly maintained industrial buildings and form a new high quality closed façade building on the southern edge of the pumping station compound. The structures would be designed to appear contiguous with the existing pumping station and would be set within the compound area. The remainder of the construction working area would be left as a cleared site in Year 1 of operation, to be bordered by a new boundary wall to the north. Given that the new structures would be similar in character to the buildings they would be replacing, the magnitude of change would be low.

11.6.8 The low magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **minor beneficial** effects.

### Townscape – sensitivity test for programme delay

11.6.9 For the assessment of townscape effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely materially to change the assessment findings reported above (paras. 11.6.4 to 11.6.8). This is on the basis that there are no known schemes that would change the sensitivity to change of the townscape character areas already presented (paras. 11.4.2 to 11.4.34).

## Visual assessment

11.6.10 For each viewpoint, an assessment of the visual effects during Year 1 of operation has been made. In each instance, the first part of the assessment relates to visual effects during winter, while the second part relates to visual effects during summer.

11.6.11 No assessment of visual effects has been made for the following viewpoints, as the components of the operational scheme would not be visible or would be barely perceptible in the background of the view:

a. London Panorama 5A – Blackheath Point, Greenwich Park to St Paul's Cathedral

b. Viewpoint 1.1: View south from residences along Yeoman Street

c. Viewpoint 1.2: View west from residences along Plough Way

d. Viewpoint 1.3: View southwest from residences along Rope Street

e. Viewpoint 1.4: View west from residences along Plough Way near Windsock Close

f. Viewpoint 1.5: View north from residences along Sapphire Road

g. Viewpoint 1.9: View east from residences along Chilton Grove

h. Viewpoint 2.1: View from the footpath and open space between residences on Chilton Grove.

### Residential

*Viewpoint 1.6: View north from residences along Woodcroft Mews; Viewpoint 1.7: View north from residences along Acacia Close; Viewpoint 1.8: View northeast from residences at the junction of Acacia Close and Croft Street; and Viewpoint 1.10: View north from newly built residences in the Cannon Wharf development (base case scheme)*

11.6.12 The proposed shaft would be visible from these residential viewpoints. The new above ground structure would replace existing dilapidated industrial units and boundary walling, remaining broadly in character with the pumping station building to the north. The view of the proposed development from Viewpoint 1.6 is illustrated in Vol 22 Plate 11.6.1 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 22 Figure 11.6.1 (see separate volume of figures). The layout of the proposed development illustrated in this photomontage may change within the zones shown on the Site works parameter plan [see separate volume of figures – Section 1], however the assessment of effects would be no worse than that described here.

**Vol 22 Plate 11.6.1 Viewpoint 1.6 – operational phase photomontage**

*Date taken: 24 March 2011. 50mm lens.*

11.6.13 Given that the proposed shaft would replace existing industrial buildings, but would not form a dominant component of the views set against the existing pumping station, the magnitude of change is considered to be low.

11.6.14 The low magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **minor beneficial** effects.

11.6.15 The assessment of effects would remain unchanged in summer.

*Viewpoint 1.11: View west from newly built residences in the Yeoman Street development (base case scheme)*

11.6.16 The foreground of the view would be characterised by the area left as a cleared site for future development in Year 1 of operation. The high quality elevation of the proposed shaft, protruding above the ground by approximately 4.7m, would be visible beyond the cleared site, replacing existing dilapidated industrial units and boundary walling. The visually attractive biodiverse roof would also be visible from upper storeys. Therefore, the magnitude of change is considered to be medium.

11.6.17 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate beneficial** effects.

11.6.18 The assessment of effects would remain unchanged in summer.

#### Visual effects – sensitivity test for programme delay

11.6.19 For the assessment of visual effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely materially to change the assessment findings reported above (paras. 11.6.11 to 11.6.18). This is on the basis that there are no known schemes within the assessment area (beyond those described in para. 11.3.21 which are already considered) that would introduce new visual receptors, or alter visibility of the proposed development from the viewpoints described in paras. 11.4.36 to 11.4.64.

### Operational effects Year 15

11.6.20 Operational effects for all townscape and visual receptors identified would remain unchanged in Year 15 compared to Year 1, due to the limited townscape and visual effects in Year 1 and the limited changes anticipated in the surrounding area in the Year 15 base case. This would also apply in the event of a programme delay to the Thames Tideway Tunnel project of approximately one year.

## 11.7 Cumulative effects assessment

### Construction effects

11.7.1 As described in Section 11.3, construction of the Marine Wharf West, Yeoman Street and part of the Cannon Wharf developments would be ongoing during Site Year 1 of construction at the Earl Pumping Station site. Cumulatively, construction activity associated with all these sites would elevate effects on the setting of all townscape character areas surrounding the site and visual assessment viewpoints during construction.

11.7.2 Significant effects on receptors arising from the proposed Thames Tunnel development would remain significant when considered with non-Thames Tunnel developments. Effects on the following visual receptors (which are not significant from the Thames Tunnel development alone) would be significant when taking into account construction at the developments described in para. 11.3.11:

a. Viewpoint 1.2: View west from residences along Plough Way

b. Viewpoint 1.4: View west from residences along Plough Way near Windsock Close

c. Viewpoint 1.7: View north from residences along Acacia Close

d. Viewpoint 1.9: View east from residences along Chilton Grove

e. Viewpoint 1.10: View north from newly built residences in the Cannon Wharf development (base case scheme).

11.7.3 Effects on the following receptors (which are not significant from the Thames Tunnel development alone) would be elevated but would remain not significant when taking into account construction at the developments described in para. 11.3.1:

a. Viewpoint 1.3: View southwest from residences along Plough Way

b. Viewpoint 1.5: View north from residences along Sapphire Road.

11.7.4 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, the developments listed in para. 11.7.1 would be assumed to be complete and operational. Therefore, there would be no cumulative effects.

### Operational effects

11.7.5 As detailed in the site development schedule (Vol 22 Appendix N) no schemes have been identified within 1km of the site which meet the criteria for inclusion in the cumulative assessment. Therefore no assessment of cumulative effects has been undertaken. This would also apply in the event of a programme delay to the Thames Tideway Tunnel project of approximately one year.

## 11.8 Mitigation

11.8.1 All measures embedded in the proposed scheme and *CoCP* of relevance to the townscape and visual assessment are summarised in Section 11.2. No mitigation is possible for residual effects due to the highly visible nature of the construction activities.

11.8.2 No mitigation is required during operation as all effects are assessed to be negligible or beneficial.

## 11.9 Residual effects assessment

### Construction effects

11.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 11.5. All residual effects are presented in Section 11.10.

### Operational effects

11.9.2 As no mitigation measures are proposed, the residual operational effects remain as described in Section 11.6. All residual effects are presented in Section 11.10.

## 11.10 Assessment summary

**Vol 22 Table 11.10.1Townscape – summary of construction assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| The site | Change to character due to demolition of existing buildings, installation of hoardings and welfare facilities, and the intensity of construction activity. | Minor adverse | None | Minor adverse |
| Cannon Wharf Business Area | Change to setting along Yeoman Street due to the presence of construction plant, welfare facilities, site hoardings, cranes and construction traffic. | Moderate adverse | No mitigation possible | Moderate adverse |
| Rotherhithe Mixed Residential | Change to setting along Chilton Grove and Croft Street due to the presence of construction plant, welfare facilities, site hoardings, cranes and construction traffic. | Moderate adverse | No mitigation possible | Moderate adverse |

**Vol 22 Table 11.10.2 Visual – summary of construction assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| **London View Management Framework** | | | | |
| London Panorama View 5A – Blackheath Point, Greenwich Park to St Paul's Cathedral | Construction works would be barely perceptible. | Negligible | None | Negligible |
| **Residential** | | | | |
| Viewpoint 1.1: View south from residences along Yeoman Street | Visibility of site hoardings, tall construction plant, cranes and construction traffic | Moderate adverse | No mitigation possible | Moderate adverse |
| Viewpoint 1.2: View west from residences along Plough Way | Intermittent visibility of tall construction plant and cranes. | Negligible | None | Negligible |
| Viewpoint 1.3: View southwest from residences along Plough Way | Intermittent visibility of tall construction plant and cranes. | Negligible | None | Negligible |
| Viewpoint 1.4: View west from residences along Plough Way near Windsock Close | Intermittent visibility of tall construction plant and cranes. | Negligible | None | Negligible |
| Viewpoint 1.5: View north from residences along Sapphire Road | Intermittent visibility of tall construction plant and cranes in the background of the view, from upper storeys. | Negligible | None | Negligible |
| Viewpoint 1.6: View north from residences along Woodcroft Mews | Oblique visibility of site hoardings, construction plant, cranes and construction traffic. | Moderate adverse | No mitigation possible | Moderate adverse |
| Viewpoint 1.7: View north from residences along Acacia Close | Partial visibility of hoardings and traffic. Intermittent visibility of tall construction | Minor adverse | None | Minor adverse |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| | plant and cranes. | | | |
| Viewpoint 1.8: View northeast from residences at the junction of Acacia Close and Croft Street | Oblique visibility of site hoardings, construction plant, cranes and construction traffic. | Moderate adverse | No mitigation possible | Moderate adverse |
| Viewpoint 1.9: View east from residences along Chilton Grove | Visibility of site hoardings, intermittent visibility of tall construction plant and cranes. | Minor adverse | None | Minor adverse |
| Viewpoint 1.10: View north from newly built residences in the Cannon Wharf Business Area development (base case scheme) | Partial visibility of hoardings and traffic. Intermittent visibility of tall construction plant and cranes. | Minor adverse | None | Minor adverse |
| **Recreational** | | | | |
| Viewpoint 2.1: View from the footpath and open space between residences on Chilton Grove | Visibility of site hoardings and traffic. Partial visibility of construction activity within the site. Intermittent visibility of tall construction plant and cranes. | Moderate adverse | No mitigation possible | Moderate adverse |

**Vol 22 Table 11.10.3 Townscape – summary of Year 1 and Year 15 operational assessment[ii]**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| The site | Removal of existing poorly maintained industrial buildings and introduction of new well designed above ground structures. | Minor beneficial | None | Minor beneficial |
| Cannon Wharf Business Area | Slight change to setting through removal of poorly maintained industrial buildings and introduction of new well designed structures. | Minor beneficial | None | Minor beneficial |
| Rotherhithe Mixed Residential | Slight change to setting through removal of poorly maintained industrial buildings and introduction of new well designed structures. | Minor beneficial | None | Minor beneficial |

[ii] Operational effects have been assessed to be the same in both Year 1 and Year 15 of operation

**Vol 22 Table 11.10.4 Visual – summary of Year 1 and Year 15 operational assessment[iii]**

| Receptor[iv] | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| **Residential** | | | | |
| Viewpoint 1.6: View north from residences along Woodcroft Mews | Visibility of the new well designed above ground shaft structure, replacing existing dilapidated industrial units. | Winter – Minor beneficial | Winter – None | Winter – Minor beneficial |
| | | Summer – Minor beneficial | Summer – None | Summer – Minor beneficial |
| Viewpoint 1.7: View north from residences along Acacia Close | Visibility of the new well designed above ground shaft structure, replacing existing dilapidated industrial units. | Winter – Minor beneficial | Winter – None | Winter – Minor beneficial |
| | | Summer – Minor beneficial | Summer – None | Summer – Minor beneficial |
| Viewpoint 1.8: View northeast from residences at the junction of Acacia Close and Croft Street | Visibility of the new well designed above ground shaft structure, replacing existing dilapidated industrial units. | Winter – Minor beneficial | Winter – None | Winter – Minor beneficial |
| | | Summer – Minor beneficial | Summer – None | Summer – Minor beneficial |
| Viewpoint 1.10: View north from newly built residences in the Cannon Wharf Business Area development (base case scheme) | Visibility of the new well designed above ground shaft structure, replacing existing dilapidated industrial units. | Winter – Minor beneficial | Winter – None | Winter – Minor beneficial |
| | | Summer – Minor beneficial | Summer – None | Summer – Minor beneficial |
| Viewpoint 1.11: View west from | Foreground visibility of the new well | Winter – | Winter – | Winter – |

[iii] Operational effects have been assessed to be the same in both Year 1 and Year 15 of operation
[iv] Viewpoints not assessed during operation (refer to para. 11.6.11) are not included in the summary table

| Receptor[iv] | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| newly built residences in the Yeoman Street development (base case scheme) | designed above ground shaft structure and visually attractive biodiverse roof, replacing existing dilapidated industrial units. | Moderate beneficial | None | Moderate beneficial |
| | | Summer – Moderate beneficial | Summer – None | Summer – Moderate beneficial |

# References

[1] Department of Environment, Food and Rural Affairs. *National Policy Statement for Waste Water* (2012). Available at: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf. Last accessed November 2012.

[2] LB of Lewisham. *LDF Core Strategy* (June 2011).

[3] LB of Southwark. *LDF Core Strategy* (April 2011).

[4] Department of Environment, Food and Rural Affairs (2012). See citation above.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Thames Water

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 12: Transport

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

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 12: Transport

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# 12 Transport

## 12.1 Introduction

12.1.1 This section presents the findings of the assessment of the likely significant transport effects of the proposed development at the Earl Pumping Station site. The project-wide transport effects are described in Volume 3 Project-wide effects assessment.

12.1.2 Construction of the proposed development at the site has the potential to affect the following transport elements:

a. pedestrian routes

b. cycle routes

c. bus routes and patronage

d. London Underground and London Overground services

e. effects on river passenger services and patronage

f. car parking

g. highway layout, operation and capacity.

12.1.3 The assessment considers the effects on each of these elements during construction, as well as effects on specific receptors including residents on Croft Street and nearby recreational facilities. It is not proposed to use the river to transport materials at this site, therefore effects river navigation is not considered at this site.

12.1.4 The operation of the Earl Pumping Station site has the potential to affect highway layout and operation and therefore effects on these are considered within the operational assessment.

12.1.5 The assessment of transport presented in this section has considered the requirements of the *National Policy Statement for Waste Water* (Defra, 2012)[1] section 4.13. Further details of these requirements can be found in Volume 2 Environmental assessment methodology Section 12.3.

12.1.6 Additionally, a separate *Transport Assessment* has been produced which provides an assessment of the effects on the transport network as a result of the construction and operational phases at the Earl Pumping Station site. The *Transport Assessment* accompanies the application for development consent (the ‘application’).

12.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station figures).

12.1.8 The separate but related assessments of effects of transport on air quality and noise and vibration are contained in Sections 4 and 9 respectively.

## 12.2 Proposed development relevant to transport

12.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to transport are set out below.

### Construction

12.2.2 The construction site would include the Thames Water Earl Pumping Station and adjacent industrial land. Vehicle access to the site would take place from Yeoman Street with the egress point onto Croft Street. Work would take place on Croft Street and Chilton Grove for short periods during the sewer connection and service diversion works. During this period it would be necessary to close part of Chilton Grove outside the Earl Pumping Station access point to traffic and to divert parts of the pedestrian footways on Yeoman Street, Croft Street and Chilton Grove.

12.2.3 During construction it is anticipated that the elements listed under para. 12.1.2 above may be affected as a result of:

a. additional construction traffic associated with the Earl Pumping Station site and other Thames Tideway Tunnel construction sites with construction routes through the A200 gyratory of Bestwood Street and Bush Road, and the gyratory of Rotherhithe New Road (A2208) and Rotherhithe Old Road (A200)

b. pedestrian diversions along Yeoman Street, Croft Street, and Chilton Grove

c. temporary removal of speed cushions along Croft Street and Chilton Grove during phases 1 and 2 of construction

d. temporary lane closure on Croft Street and Chilton Grove during the construction period

e. temporary restriction of unmarked kerbside parking along Yeoman Street to the south of the junction with Chilton Grove, and along the southern section of Chilton Grove between the junctions with Yeoman Street and Croft Street during the construction period

f. temporary restriction of car parking bays along Chilton Grove and Croft Street.

12.2.4 Details of the peak year of construction, anticipated lorry movements and the activities which would generate these movements are provided in Vol 22 Table 12.2.1.

**Vol 22 Table 12.2.1 Transport – construction details**

| Description | Assumption |
|---|---|
| Assumed peak period of construction lorry movements | Site Year 1 of construction |
| Assumed average peak daily construction lorry vehicle movements (in peak month of Site Year 1 of construction) | 68 movements per day<br>(34 lorry trips) |
| Typical types of lorry requiring access<br>(comprising rigid-bodied, flatbed and articulated vehicles) | Excavated material lorries<br>Plant and equipment deliveries<br>Imported fill lorries<br>Ready mix concrete lorries<br>Steel reinforcement rebar lorries<br>Office/general delivery lorries<br>Temporary construction material lorries including pipe/track/oils /greases lorries |

*Note: a movement is a construction vehicle moving either to or from the site. A Site Year is a 12 month period, one in a series of Site Years; Site Year 1 commences at the start of construction.*

12.2.5 During construction all construction material would be transported by road.

12.2.6 Vehicle movements would take place during the standard day shift of ten hours on weekdays (08:00 to 18:00) and five hours on Saturdays (08:00 to 13:00). It would be only in exceptional circumstances that HGV and abnormal load movements could occur up to 22:00 on weekdays for large concrete pours and later at night by agreement with the LB of Lewisham.

### Construction traffic routing

12.2.7 The access plan and highway layout during construction plans (see separate volume of figures – Section 1) present the highway layout during construction.

12.2.8 Site access would be via a right turn from Yeoman Street. Egress would be via a right turn onto Croft Street.

12.2.9 The site is located 400m from the Strategic Road Network (SRN) on Lower Road (A200), with road access to the site along Plough Way (B206) and then Yeoman Street.

12.2.10 Traffic leaving the site would egress onto Croft Street, Chilton Grove, Yeoman Street and then onto Plough Way (B206) before turning left onto Lower Road (A200). Construction traffic would then travel southbound along the A200 towards the A2.

12.2.11 Construction traffic heading north would turn left onto Lower Road (A200) and then use the A200 gyratory of Bestwood Street and Bush Road (A200) before continuing northbound along the A200.

12.2.12 Vol 22 Figure 12.2.1 (see separate volume of figures) shows the construction traffic routes for access to/from Earl Pumping Station. Construction routes have been discussed with Transport for London (TfL) and the Local Highway Authorities (LHAs), the London Borough (LB) of Lewisham and the London Borough (LB) of Southwark for the purposes of the assessment.

### Construction workers

12.2.13 The construction site is expected to require a maximum workforce of approximately 40 workers at any one time. The number and type of workers is shown in Vol 22 Table 12.2.2.

**Vol 22 Table 12.2.2 Transport – maximum estimated construction workers numbers**

| Contractor | | Client |
|---|---|---|
| **Staff*** | **Labour**** | **Staff***** |
| **08:00-18:00** | **08:00-18:00** | **08:00-18:00** |
| 15 | 20 | 5 |

**Staff Contractor – engineering and support staff to direct and project manage the engineering work and site.*
***Labour – those working on site doing engineering, construction and manual work.*
****Staff Client – engineering and support staff managing the project and supervising the Contractor.*

12.2.14 It is difficult to predict with certainty the directions to and from which workers at the site would travel. Staff could potentially be based in the local area or in the wider Greater London area and are unlikely to have the same origin-destination distributions as construction lorries.

12.2.15 On this basis it has been assumed that the origins of worker vehicle trips would be similar to the origins of trips to the zone in the TfL Highway Assignment Model (HAM) in which Earl Pumping Station site is located.

12.2.16 The methodology for assigning worker trips to the transport networks is described in Vol 2 Section 12.

12.2.17 At the Earl Pumping Station site it is assumed that while there would be no parking provided within the site boundary for construction workers, and measures would be incorporated into site-specific *Travel plan* requirements in order to minimise the number of workers travelling to and from the site by car (in accordance with the overall aims and objectives of the *Draft Project Framework Travel Plan* which accompanies the application), some construction workers are expected to drive to the site. This is therefore considered as part of the assessment, further details of which are provided in paras. 12.5.2-12.5.3.

## Code of Construction Practice

12.2.18 Measures incorporated into the *Code of Construction Practice (CoCP)*[i] *Part A* (Section 5) to reduce transport effects include:

a. site specific *Traffic Management Plans (TMP)*: to set out how vehicular access to the site would be managed so as to minimise impact on the local area and communicate this with the local borough and other stakeholders. This includes any works on the highway, diversion or temporary closure of the highway or public right of way

b. HGV management and control: to ensure construction vehicles use appropriate routes to the sites and the vehicle fleet and/or drivers meet current safety and environmental standards.

12.2.19 In addition to the general transport measures within the *CoCP* Part A Section 5, the following site specific measures have been incorporated into the *CoCP* Part B Earl Pumping Station (Section 5):

a. access to the site would be from Plough Way (B206), right into Yeoman Street and right into the site

b. site egress would be onto Croft Street with only a right turn out, along Chiltern Grove and Yeoman Street, then travel along Plough Way (B206) towards Lower Road (A200). Access through Croft Street to the south and Chilton Grove to the west would not be permitted

c. suitable traffic management would be required during the connection to the existing sewer and service diversion works in Chilton Grove and Croft Street during diversion of the Earl sewer around the drop shaft. During this phase site egress would be onto Yeoman Street

d. revised parking arrangements and necessary suspensions would be agreed with LB of Lewisham and LB of Southwark

e. highway layout changes including removal of traffic calming features and junction modifications (requiring short-term pedestrian and traffic management) would be agreed with LB of Lewisham and LB of Southwark

f. the footway diversions on Croft Street, Chilton Grove and Yeoman Street would be adequately signed and protected.

12.2.20 The effective implementation of the *CoCP* Part A and Part B Section 5 measures is assumed within the assessment.

12.2.21 Based on current travel planning guidance including TfL's *Travel Planning for new development in London* (TfL, 2011)[2], this development falls within the threshold for producing a Strategic Framework Travel Plan. A *Draft Project Framework Travel Plan* has been prepared based on the TfL ATTrBuTE guidance (TfL, 2011)[3]*;* and it accompanies the application. The *Draft Project Framework Travel Plan* addresses project-wide travel planning measures, including the need for a project-wide Travel Plan

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[i] The *Code of Construction Practice (CoCP)* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

Manager, initial travel surveys during construction and a monitoring framework. It also contains requirements and guidelines for the site-specific *Travel plans* to be prepared by the site contractors. The site-specific travel planning requirements of relevance to the *Draft Project Framework Travel Plan* are as follows:

a. information on existing transport networks and travel initiatives for the Earl Pumping Station site

b. a mode split established for the Earl Pumping Station site construction workers to establish and monitor travel patterns

c. site-specific targets and interim targets based on the mode share which would link to objectives based on local, regional and national policy

d. a nominated person with responsibility for managing the *Travel plan* monitoring and action plans specifically for this site.

### Operation

12.2.22 During operation the site would be accessed from Croft Street or the existing pumping station access point on Yeoman Street and Chilton Grove (via Plough Way (B206)), as detailed in the Earl Pumping Station design principles (see *Design Principles* report Section 4.18 in Vol 1 Appendix B).

12.2.23 Access would be required for a light commercial vehicle on a three to six monthly maintenance schedule. Additionally there would be more substantive maintenance visits at approximately ten years intervals which would require access to enable two cranes and associated support vehicles to be brought to the site.

## 12.3 Assessment methodology

### Engagement

12.3.1 Vol 2 documents the overall engagement, which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of traffic and transport are presented in Vol 22 Table 12.3.1.

12.3.2 It was reported in the *Scoping Report* (Thames Water, 2011)[4] that operational traffic effects for the project as a whole were scoped out of the EIA. However, while the environmental effects associated with transport for the operational phase are not expected to be significant or adverse, the assessment of transport effects in the *Environmental Statement* examines relevant aspects of the operational phase in order to satisfy the relevant stakeholders that technical issues have been addressed.

**Vol 22 Table 12.3.1 Transport – stakeholder engagement**

| Organisation | Comment | Response |
|---|---|---|
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The predicted volumes and movements are based on assumed timings for the works and remain subject to change. It is difficult to assess the impact of the works without actual numbers of construction vehicle movements in the vicinity of the site. | The assessment is based on the average daily number of vehicles in the peak month(s) of activity and therefore represents the upper bound of number of movements that could be expected on any day within the overall programme. Any exceedance of this figure would be very infrequent in the context of the overall construction programme. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The construction period is divided into two phases; however, the transport assessment does not specify the length of each phase. This information should be provided in order to determine the duration of the impact for each phase. | Information regarding the construction phases at the Earl Pumping Station site is provided in Section 3.3. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The transport assessment does not provide details of how the construction route would be enforced or details of measures to prevent construction vehicles using alternative routes. | The *CoCP* Section 5 contains requirements for the production of *Traffic Management Plans* by contractors which would contain arrangements for construction routes and vehicle management and would be agreed with the LB of Lewisham. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | Swept path analysis is required within the transport assessment to show the construction vehicle movements when accessing/exiting the site. | The highway layout during construction vehicle swept path analysis plan has been provided in the Earl Pumping Station *Transport Assessment* figures that accompany the application. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The transport assessment does not include a full breakdown of accidents and causes. | The Earl Pumping Station *Transport Assessment* figures that accompany the application include pedestrian and cycle accidents by severity that occurred within the vicinity of the Earl Pumping Station site. |

| Organisation | Comment | Response |
|---|---|---|
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The transport assessment does not provide information on the duration of the loading process. This information is required to determine if construction vehicles accessing the site would queue on the highway. Construction vehicles queuing on the highway would have an impact on traffic flow and highway safety. | This would form part of the *Traffic management plan* which contractors would be required to prepare under the *CoCP* Section 5. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The transport assessment should include a safety audit that considers the proposal to temporarily remove three speed cushions, the proposed amendments to the carriageway, and the proposed closures of the footways in the vicinity of the site, to demonstrate that safety issues have been sufficiently considered. | Stage 1 Road Safety Audits have been carried out on the illustrative highway layouts proposed for this site. The *Road Safety Audits* for this site are contained in Section 22 Appendix E of the *Transport Assessment* that accompanies the application. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The assessment fails to consider or highlight that the unrestricted parking is located within LB Lewisham and the resident parking is within LB Southwark. This is a relevant issue within the assessment because LB Lewisham residents cannot park in LB Southwark resident parking bays. | The assessment and associated commentary address this issue. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | LB Lewisham has not seen the ELHAM data held on the model and the transport assessment does not include any outputs from the model. So the cumulative impacts of the proposal cannot be assessed. | Information on the outputs from the HAMs is contained in Vol 3 Section 12. |
| LB of Lewisham / Transport for London, Transport | Does the ELHAM consider the growth in all modes of travel on the network? | ELHAM is a highway model and therefore only considers the growth in highway trip |

| Organisation | Comment | Response |
|---|---|---|
| Assessment workshop, November 2012 | | demand. |
| LB of Lewisham / Transport for London, Transport Assessment workshop, November 2012 | The predicted growth in pedestrian and cycle trips in the borough should be considered when assessing the impact of vehicle routing and when considering impacts associated with amendments to the highway. | This has been taken into consideration in the assessment. |
| Transport for London, Transport Assessment workshop, November 2012 | Information on construction traffic associated with other Thames Tideway Tunnel sites should be provided. | The OmniTrans outputs used for the assessment identify lorry traffic which would be associated with the Earl Pumping Station site, or with other Thames Tideway Tunnel sites, that would use routes in the vicinity of the Earl Pumping Station site. |
| LB of Southwark / Section 48 consultation, October 2012 | Although located within the London Borough of Lewisham, Earl Pumping Station adjoins the boundary with Southwark. There is a significant risk of impacts upon the residential properties in Southwark given their location facing the north west and southwest boundaries of the site. | The effect on residential properties close the site has been assessed (see Section 12.5). |
| LB of Lewisham, Borough meeting, July 2012 | LB of Lewisham raised concerns about accessing the site, in terms of residential parking displacement and using residential streets. | Resident parking bays with capacity for one vehicle on Croft Street and approximately seven vehicles on Chilton Grove would be temporarily restricted during phases 1 and 2 respectively. No reprovision would be required as there is sufficient spare capacity to accommodate this displacement as described in para. 12.4.73. This has been taken into consideration within the assessment. |
| LB of Lewisham, | Consideration must be given to adjacent masterplan (Marine | This has been included within the assessment. |

| Organisation | Comment | Response |
|---|---|---|
| Borough meeting, July 2012 | Wharf West) under development. | |
| LB of Lewisham, phase two consultation, February 2012 | Impact of the construction vehicle movements on the residential properties close to the site is significant as they are quiet traffic calmed streets. | The effect on residential properties close the site has been assessed (see Section 12.5). |
| LB of Lewisham, Borough meeting, July 2012 Phase two consultation, February 2012 | Removal of traffic calming measures as a result of the proposal would lead to increased vehicles speeds which would have highway safety implications. | Speed cushions would be temporarily removed from Croft Street (outside site access point) and Chilton Grove during phases 1 and 2 of construction to accommodate construction vehicles arriving/departing the site and would be reinstated at the end of construction. During phase 1 of construction, three new speed cushions would be installed to the south of the site access point on Croft Street to reduce vehicle speeds. |
| LB of Lewisham, phase two consultation, February 2012 | Clarity on which car parking bays close to the site are to be removed and if there are any proposals to relocate them. | Parking bays would need to be temporarily restricted along Chilton Grove and Croft Street during construction which has been taken into consideration in the assessment (see Section 12.5). |
| LB of Lewisham, phase two consultation, February 2012 | The impact on the cycle superhighway along Evelyn Street to be considered in the assessment. | The impact on cyclists has been taken into consideration within the assessment. This includes the impacts on the cycle superhighway along Evelyn Street (A200) (see Section 12.5). |
| LB of Lewisham, phase two consultation, February 2012 | A full transport assessment of the impact of construction traffic given the potential effects associated with the construction of other developments in the area, particularly the Council's Strategic Sites. | The assessment considers the effects of the project in the context of other committed developments and infrastructure schemes in the area, at both strategic and local levels. |
| LB of Lewisham, | Unless further information is provided demonstrating that | The assessment has been based on the proposed |

| Organisation | Comment | Response |
|---|---|---|
| phase two consultation, February 2012 | the impacts of the proposal can be satisfactory mitigated, the proposal would be contrary to Core Strategy Policy 14. | development including measures incorporated in the design together with those set out in the *CoCP* Section 5 and the *Draft Project Framework Travel Plan* which accompanies the application. |
| Transport for London, phase two consultation, February 2012 | Give consideration to the opportunity to tranship materials to and from the site locally to the safeguarded Convoys Wharf | As set out in the *Transport Strategy*, the proposals at the Earl Pumping Station site are for the transport of materials by road to/from this site. |
| Transport for London, consultation workshop, September 2011 | Operation of the SRN/TLRN in the vicinity of Earl Pumping Station. | This has been taken into consideration within the assessment through modelling and analysis (see Section 12.5). |
| Transport for London, consultation workshop, September 2011 | Consider using A2208 as secondary route for construction traffic. | The A2208 is not part of the Transport for London Road Network (TLRN) or Strategic Road Network (SRN) and therefore the A200 is proposed as the construction traffic route for this site. |
| Transport for London, consultation workshop, September 2011 | Convoys Wharf development has been put forward to Network Management Group. | This development has been taken into consideration within the assessment. |
| Transport for London, consultation workshop, September 2011 | A202 triangle shown on previous construction routing plans should be removed as this has been modified to prevent traffic movements. | This has been removed from the construction traffic route plan in Vol 22 Figure 12.2.1 (see separate volume of figures). |
| Transport for London, consultation workshop, September 2011 | Construction vehicle routing - consider avoiding Deptford Church Street if possible. | Modelling and assessment shows that construction traffic can be managed with other vehicles along Deptford Church Street (A2209). |

## Baseline

12.3.3 The baseline methodology follows the methodology described in Vol 2 Section 12. However, no local traffic modelling has been undertaken for the junction of Plough Way (B206) and Yeoman Street due to the low traffic flows at this junction and the very small impact of the Thames Tideway Tunnel project on the operation of this junction. Survey results have instead been used to understand the existing capacity and operation of the junction (as described in para. 12.4.71 below).

## Construction

12.3.4 The assessment methodology for the construction phase follows that described in Vol 2 Section12 with the exception, as described above, of the junction of Plough Way (B206) and Yeoman Street where no local traffic modelling has been undertaken due to the low traffic flows. The assessment undertaken is therefore qualitative, based on professional judgement drawing on survey data and the strategic traffic modelling (which covers all Thames Tideway Tunnel sites) as appropriate. This enables the effect of all other Thames Tideway Tunnel sites on the area surrounding Earl Pumping Station to be taken into account within the assessment of the peak year of construction at this site.

12.3.5 The effect of all other Thames Tideway Tunnel sites on the area surrounding the Earl Pumping Station site has been taken into account within the assessment of the peak year of construction at this site.

12.3.6 As indicated in the Development Schedule (see Vol 22 Appendix N), six developments identified within 1km of the Earl Pumping Station site would be complete and operational by Site Year 1 of construction. These developments have therefore been included in the construction base case. They comprise:

a. mixed-use development of Tavern Quay

b. mixed-use development at Surrey Quays Leisure site

c. mixed-use development at Canada Water site

d. redevelopment of existing retail warehouses in Canada Water

e. mixed-use development of Quebec Way Industrial Estate

f. mixed-use development of Mulberry Business Park.

12.3.7 The mixed-use developments of Cannon Wharf and Surrey Canal Triangle would be partially complete and operational by Site Year 1 of construction; however, some phases of these developments would still be under construction in Site Year 1 of construction.

12.3.8 In addition, the development of Marine Wharf West, construction of a five storey building on Yeoman Street, phases 1 and 2 of Convoys Wharf and the Oxestalls Road redevelopment would be under construction in Site Year 1 of construction. As there would be other developments under construction at the same time as the construction works at the Earl Pumping Station site, this means that the transport assessment should consider cumulative effects. However, the TfL Highway Assignment

Models (HAM) which have been used in the transport assessment have been developed using GLA employment and population forecasts, which are based on the employment and housing projections set out in the *London Plan 2011* (GLA, 2011)[5]. As a result, the assessment inherently takes into account a level of future growth and development across London.

12.3.9 This means that the trips associated with the other developments outlined within the Development Schedule (see Vol 22 Appendix N) within 1km of the Earl Pumping Station site which could alter the operation of the transport networks in the future are already taken into consideration within the traffic modelling.

### Construction assessment area

12.3.10 The assessment area for the Earl Pumping Station site includes the site access routes onto Yeoman Street, Croft Street and Chilton Grove from Plough Way (B206). The assessment area also includes the junction of Lower Road (A200), Rotherhithe New Road (A2208) and Plough Way (B206) approximately 400m to the northwest, and the junction of Plough Way (B206) and Yeoman Street, approximately 150m to the north.

12.3.11 These roads and the junction have been assessed for highway, cycle and pedestrian impacts. Effects on local bus services within 640m of the site and rail services within 960m of the site have also been assessed[ii].

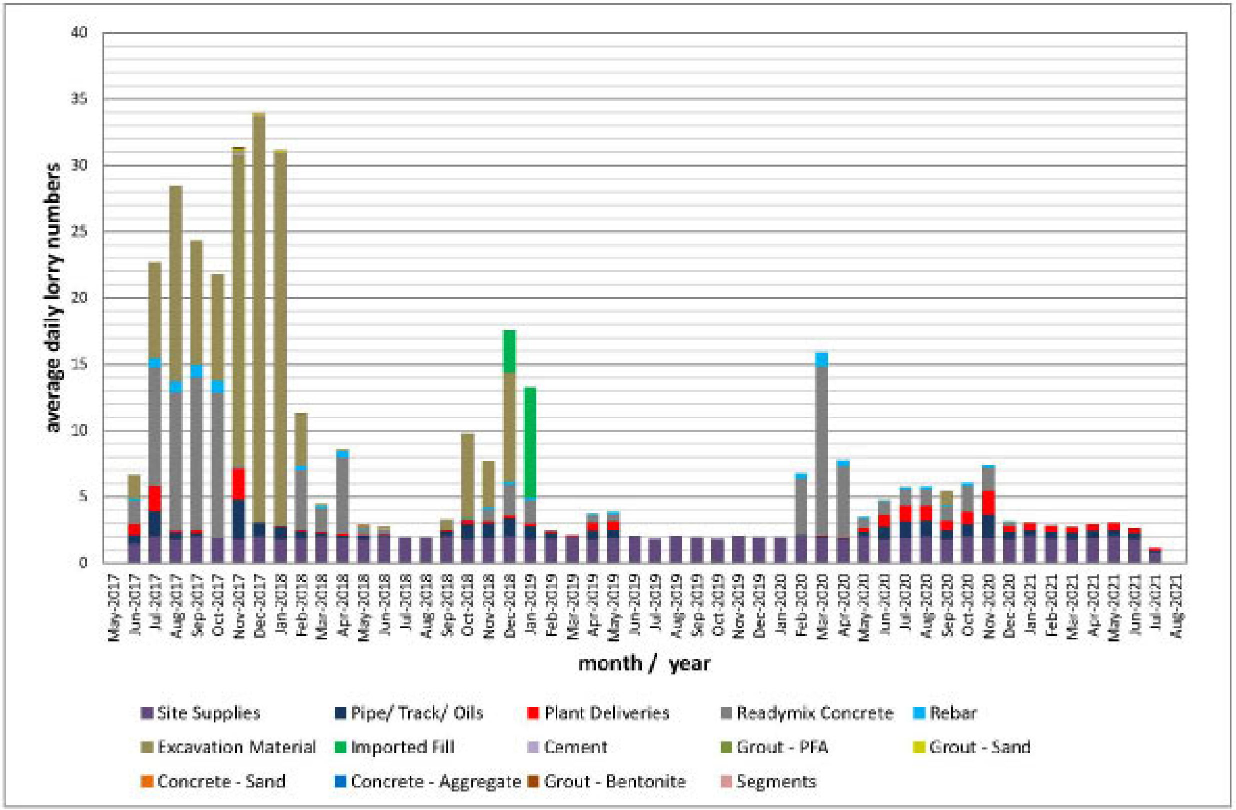
### Construction assessment year

12.3.12 A site-specific peak construction assessment year has been identified. The histogram in Vol 22 Plate 12.3.1 shows that the peak site-specific activity at the Earl Pumping Station site would occur in Site Year 1 of construction.

12.3.13 The assessment of construction effects also considers the extent to which the assessment findings would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

[ii] Distances derived from the Public Transport Accessibility Level (PTAL) methodology described in Vol 2 Section 12.

## Vol 22 Plate 12.3.1 Transport – estimated construction lorry profile




*Note: Plate shows approximate volumes and number of lorry trips based upon assumed timings for the works. It is not a programme and remains subject to change.*

## Operation

12.3.14 The assessment methodology for the operational phase follows that described in Vol 2 Section 12. There are no site-specific variations for undertaking the operational assessment of this site.

12.3.15 Once the Thames Tideway Tunnel project is operational it is not expected that there would be any significant effects on the transport infrastructure and operation within the local area, because maintenance trips to the site would be infrequent and short-term. On this basis, it is not necessary to assess the effects on all the elements listed at para. 12.1.2. The only elements considered are effects on highway layout and operation.

12.3.16 These elements are considered qualitatively (as described in Vol 2 Section 12) due to the minimal effect on the highway network. The scope of this analysis has been discussed with the LB of Lewisham and TfL.

12.3.17 Also, given the local level of transport activity associated with the Thames Tideway Tunnel project during the operational phase, only the localised transport effects around the Earl Pumping Station site have been assessed. Other Thames Tideway Tunnel project sites would not alter the local effects around Earl Pumping Station and therefore they have not been considered in the assessment.

12.3.18 With regard to other developments in the vicinity of the site, all the developments detailed in Vol 22 Appendix N would be complete and operational by Year 1 of operation (forming part of the operational base case) with the exception of the Surrey Canal Triangle development for which phase 5 would still be under construction.

### Operational assessment area

12.3.19 The assessment area for the operational assessment remains the same as for the construction assessment as set out in para. 12.3.10.

### Operational assessment year

12.3.20 As outlined in Vol 2 Section 12 the operational assessment year is Year 1 of operation. As the number of vehicle movements associated with the operational phase is low, there is no requirement to assess any other year beyond that date.

12.3.21 As with construction, the assessment of operational effects also considers the extent to which the assessment findings would be likely to be materially different should the programme for the Thames Tideway Tunnel project (and hence opening year) be delayed by approximately one year.

## Assumptions and limitations

12.3.22 The general assumptions and limitations associated with this assessment are presented in Vol 2 Section 12.

### Assumptions

12.3.23 Local junction modelling for the construction base and development cases at this site has incorporated traffic signal optimisation on the basis that this would be implemented as necessary by TfL (as part of routine management) to ensure the effective operation of the highway network and respond to changes in traffic conditions.

12.3.24 There would be deliveries of fuel for construction plant at this site and a number of construction products may be classified as hazardous. For the Earl Pumping Station site, it is assumed that there would be one hazardous load per fortnight generated by the site.

12.3.25 With regard to construction workers travelling to the site, it is assumed that some construction workers may drive to the site and this is taken into account in the assessment.

### Limitations

12.3.26 There are no site-specific limitations of the transport assessment undertaken for this site.

## 12.4 Baseline conditions

12.4.1 The following section sets out the baseline conditions for transport within and around the site. Future baseline conditions (base case) are also described.

### Current baseline

12.4.2 The site is located in the LB of Lewisham, adjacent to the boundary with the LB of Southwark as shown in Vol 22 Figure 12.4.1 (see separate volume of figures).

12.4.3 The site is approximately 400m from the SRN on Lower Road (A200), with road access to the site along Croft Street and Yeoman Street.

### Pedestrian routes

12.4.4 The existing pedestrian network in the vicinity of the site is shown in Vol 22 Figure 12.4.2 (see separate volume of figures).

12.4.5 Located to the east of the site, Yeoman Street provides a north-south link for pedestrians between the site and Plough Way (B206). Yeoman Street leads to a service yard to the south. Yeoman Street has footways of between 1.5m and 1.8m along both sides of the two-way road with dropped kerbs where it meets Chilton Grove and Plough Way (B206).

12.4.6 Croft Street is located to the west of the site providing a north-south link between Plough Way (B206) and the site and an east-west link between Lower Road (A200) and the site. Footways of approximately 2m wide run along both sides of Croft Street with dropped kerbs provided at the junction with Woodcroft Mews. A raised table pedestrian crossing is provided where Croft Street meets Lower Road (A200) at a priority T-junction.

12.4.7 Chilton Grove is located to the north of the site and provides an east-west link between Lower Road (A200) to the west and Yeoman Street and Croft Street to the east. Footways of approximately 1.5m wide run along both sides of the road with dropped kerbs provided where the road meets Yeoman Street, Croft Street, and Lower Road (A200).

12.4.8 To the north of the site, Plough Way (B206) provides an east-west link between Lower Road (A200) and Rotherhithe New Road (A2208) to the west and Grove Street to the east. Yeoman Street is accessed via Plough Way (B206), approximately 300m from the junction with Lower Road (A200) and Rotherhithe New Road (A2208).

12.4.9 Plough Way (B206) has footways of between 2m and 6.5m wide along both sides of the road. To the east of the junction with Yeoman Street, a pedestrian refuge island is provided on Plough Way (B206) for pedestrians wishing to cross Plough Way (B206).

12.4.10 Lower Road (A200) runs in a north-south direction to the west of the site and has footways of between 1.7m and 5m wide along both sides of the road.

12.4.11 Signalised pedestrian crossings are provided to the north, east and west of the junction of Lower Road (A200) / Rotherhithe New Road (A2208) / Plough Way (B206) with a pedestrian refuge island on Rotherhithe New Road (A2208) on the approach to the junction.

12.4.12 At the junction of Lower Road (A200) with Evelyn Street (A200) and Bestwood Street (A200), zebra crossing facilities are provided with a pedestrian refuge island in the middle of the junction.

12.4.13 The Thames Path runs approximately 730m walking distance to the east of the site, adjacent to the River Thames. The Thames Path continues to the north along Rope Street and Helsinki Square, and to the south along Deptford Wharf and Foreshore.

### Cycle routes

12.4.14 The existing cycle network and facilities in the vicinity of the site are shown in Vol 22 Figure 12.4.2 (see separate volume of figures).

12.4.15 The main cycle route within the area is National Cycle Network (NCN) Route 4 (traffic-free) which routes through central London. In the local area, NCN Route 4 runs to the east of the site, approximately 700m away. Cyclists can use Cunard Walk and Rope Street (both approximately 200m to the north of the site) which leads to NCN Route 4. The route continues south along the Thames Path, adjacent to the River Thames, and north along South Sea Street.

12.4.16 There is a cycle path (on-road) running along Brunswick Quay, approximately 600m to the north of the site. The path continues north across Russia Dock Woodland and west along Deal Porters Way, Lower Road (A200), and Gomm Road.

12.4.17 On Plough Way (B206) one cycle stand is located to the east of the junction with Trident Street approximately 330m from the site and one to the east of the junction with Lower Road (A200) approximately 375m from the site.

12.4.18 Six cycle stands are provided along Rope Street, outside Greenland Pier and to the north of Greenland Dock approximately 700m from the site. Further cycle stands are provided along Lower Road (A200) 25m southeast of the junction with Plough Way (B206) and at a distance of approximately 400m from the site

12.4.19 Currently, there is no Cycle Superhighway (CS) in the vicinity of the site; however, CS4 is a planned future route running between Woolwich and London Bridge which is expected to open in 2015.

12.4.20 Currently, there is no cycle hire docking station in the vicinity of the site.

### Public Transport Accessibility Level

12.4.21 The Public Transport Accessibility Level (PTAL) of the site has been calculated using TfL's approved PTAL methodology (TfL, 2010)[6] and assumes a walking speed of 4.8km/h and considers rail stations within a 12 minute walk (960m) of the site and bus stops within an eight minute walk (640m).

12.4.22 Using this methodology the site has a PTAL rating of 3, rated as 'moderate' (with 1 being the lowest accessibility and 6b being the highest accessibility).

12.4.23 Vol 22 Figure 12.4.3 (see separate volume of figures) shows the public transport network around the Earl Pumping Station site.

### Bus services

12.4.24 As shown in Vol 22 Figure 12.4.3 (see separate volume of figures), a total of four daytime and two night-time bus routes operate within 640m of the site serving the local destinations.

12.4.25 These bus routes operate from the following bus stops:

a. Yeoman Street bus stop on Plough Way (B206) - northbound and southbound, 145m walking distance north of the site

b. Lower Road/Plough Way bus stop on Lower Road (A200) - southbound only, 280m walking distance west of the site.

c. Bestwood Street bus stop on Evelyn Street (A200) - northbound and southbound, 440m walking distance southwest of the site

12.4.26 These routes would also serve other stops further from the site as shown on Vol 22 Figure 12.4.3 (see separate volume of figures).

12.4.27 On average there are 49 daytime bus services per hour in the AM peak and PM peak hours (two-way direction) within a 640m walking distance of the site.

12.4.28 On average there are seven night-time bus services per hour Monday – Friday between 00:00 – 06:00 and 11 bus services per hour on Saturdays between 00:00 – 06:00 (two-way direction) within a 640m walking distance of the site.

### London Underground and Overground

12.4.29 As shown on Vol 22 Figure 12.4.3 (see separate figures volume), Canada Water Underground station is the closest underground station to the site, located approximately 1.4km walking distance to the northwest. Canada Water Underground station is served by the Jubilee Line which travels east to Stratford and west to Stanmore.

12.4.30 There are approximately 28 services in the AM and PM peak hours travelling to Stanmore and approximately 29 services travelling to Stratford in the AM and PM peak hours providing a total of 57 services during the peak hours.

12.4.31 Surrey Quays station is the closest Overground station to the site, at a distance of approximately 760m to the northwest. The station is served by the London Overground routes providing northbound services to Highbury and Islington and Dalston Junction, and southbound services to West Croydon, Crystal Palace and New Cross.

12.4.32 On average there are approximately 12 services during the AM and PM peak hours towards New Cross and West Croydon and there are 14 services in the AM peak hour and 12 services in the PM peak hour towards Highbury and Islington.

12.4.33 On average there are therefore 26 and 24 London Overground services per hour in total during the AM and PM peak hours respectively from Surrey Quays station.

### National Rail

12.4.34 As shown on Vol 22 Figure 12.4.3 (see separate figures volume), there are no National Rail services within a 960m walking distance of the proposed Earl Pumping Station site. The closest National Rail station to the site is South Bermondsey, located approximately 1.7km walking distance to the southwest.

### River passenger services

12.4.35 Earl Pumping Station is located approximately 800m walking distance to the west of Greenland Pier. The pier is served by Thames Clippers services which run between Embankment Pier to the west and Woolwich Arsenal Pier in the east. These river services are shown on Vol 22 Figure 12.4.3 (see separate figures volume).

12.4.36 Eastbound services from Greenland Pier start at 10:55 running until 23:43. During the AM weekday peak, there is no eastbound river service from this pier; however, the frequency of the PM weekday peak is approximately every 20 minutes in the eastbound direction.

12.4.37 The westbound services begin at 06:24 from this pier running until 22:34. During the AM and PM weekday peaks, the frequency of the westbound services is approximately 10-20 minutes per hour.

12.4.38 Weekend river services at Greenland Pier begin at 10:08 in the eastbound direction and run until 23:43 with a frequency of every 20 minutes in peak hours. The westbound weekend services start at 08:59 and arrive every 20 minutes at the pier during the peak hours. The last river service is at 22:34.

### Parking

12.4.39 Vol 22 Figure 12.4.4 (see separate volume of figures) shows the locations of the existing car parks and car club spaces within the vicinity of the site.

### Existing on-street car parking

12.4.40 There is capacity to accommodate approximately 180 vehicles in unmarked parking zones at the kerbside on Croft Street, Yeoman Street, Chilton Grove, and Plough Way (B206) (between the junction with Lighter Close and the junction with Lower Road (A200)) which are located close to the site. There are also 131 resident parking bays on these roads.

12.4.41 On Croft Street, Chilton Grove, and Plough Way (B206) (between the junction with Lighter Close and the junction with Lower Road (A200)), there are four blue badge parking bays.

12.4.42 Seven pay and display parking bays are provided on Rotherhithe New Road (A2208) to the west of the junction with Lower Road (A200) and Plough Way (B206).

12.4.43 Capacity for approximately 375 vehicles is available on Acacia Close, the access road to Iceland Wharf, Boatlifter Way, Greenland Quay, Rope Street and Sweden Gate in the form of unmarked bays. These are located between 165m and 700m walking distance from the site. There are also three resident parking bays on Trident Street.

### Car clubs

12.4.44 The closest car club parking space to the site is operated by ZipCar and is approximately 350m walking distance from the site on Greenland Quay to the north of the junction with Plough Way (B206) where one car space is provided.

## Servicing and deliveries

12.4.45 A loading bay is located approximately 480m walking distance to the northwest of the site, along Lower Road (A200) to the south of the junction with Cope Street.

## Highway network

12.4.46 As shown in Vol 22 Figure 12.4.1 (see separate volume of figures), the site is 400m walking distance from the SRN on Lower Road (A200). The site is bounded by Chilton Grove to the north, Yeoman Street to the east and Croft Street to the west.

12.4.47 Croft Street is a one-way road northbound from the eastbound section of Croft Street to Chilton Grove with a 20mph speed limit. To the west, Chilton Grove meets Lower Road (A200) at a priority T-junction and to the east meets Yeoman Street at a priority T-junction.

12.4.48 Yeoman Street links to Plough Way (B206) to the north and a service yard to the south. A 20mph speed limit applies on Yeoman Street.

12.4.49 Plough Way (B206) has a signal-controlled junction with Lower Road (A200) and Rotherhithe New Road (A2208) some 400m to the west of the site. A 30mph speed limit applies at these roads.

12.4.50 Lower Road (A200), Jamaica Road (A200) and Brunel Road (B205) meet at a large roundabout approximately 1.5km to the northwest of the site. Jamaica Road (A200) and Rotherhithe Tunnel (A101) both form part of the TLRN.

12.4.51 To the south, Lower Road (A200) links to Evelyn Street (A200) and Bestwood Street (A200) at a priority T-junction. Evelyn Street (A200) is a two-way single carriageway with a 30mph speed limit and is part of the SRN.

12.4.52 Bestwood Street (A200), Bush Road (A200), Rotherhithe New Road (A2208) and Lower Road (A200) form a one-way gyratory system surrounding Surrey Quays Overground station.

## Data from third party sources

### Description of data

12.4.53 Data in relation to traffic flows and accidents have been sourced from TfL.

### Accident analysis

12.4.54 A total of 32 road traffic accidents have occurred in the Earl Pumping Station assessment area over the five year period analysed. Of these accidents, 29 were classified as slight and three were classified as serious.

12.4.55 Of the total accidents, only one accident which occurred in the assessment area involved a goods vehicle, which was recorded as slight.

12.4.56 In total, nine pedestrians were involved in the accidents and of these one was recorded as a serious and eight as slight accidents.

12.4.57 Of the total accidents, five accidents involved cyclists, all of which were classified as slight.

12.4.58 Over the five years of accident data analysed none of the accidents happened as a result of the road geometry.

### Traffic flow data analysis

12.4.59 TfL carried out a junction survey at the junction of Lower Road (A200) and Plough Way (B206) in March 2010. Analysis of this data identified the two-way traffic flows along Plough Way (B206) at that time. The weekday two-way AM peak hour traffic flows were 139 vehicles and the two-way PM peak hour traffic flows were 215 vehicles.

12.4.60 In addition, analysis of this data was used to validate the additional traffic surveys undertaken in 2011 which are described in paras. 12.4.70-12.4.71.

## Survey data

### Description of surveys

12.4.61 Baseline survey data were collected in May and July 2011 to establish the existing transport movements and parking usage in the area. Vol 22 Figure 12.4.5 (see separate volume of figures) shows the survey locations in the vicinity of the site.

12.4.62 As part of the surveys in May and July 2011, manual and automated traffic surveys were undertaken to establish specific traffic, pedestrian and cycle movements including turning volumes, queue lengths and traffic signal timings. Parking surveys were undertaken to establish the usage of on-street car parking in the area.

### Results of the surveys

12.4.63 The surveys inform the baseline situation in the area surrounding the site.

*Pedestrians and cyclists*

12.4.64 Pedestrian surveys around the site during the AM and PM peaks indicate that six pedestrians travelled east and 27 travelled west on the footway that crosses Yeoman Street at the junction with Plough Way (B206) in the AM peak hour. The flows are lighter in the PM peak hour with five eastbound and seven westbound pedestrians.

12.4.65 During the AM peak hour, there is a heavy flow of cyclists, approximately 450, along Rotherhithe New Road (A200), Rotherhithe Old Road (A200), and Bestwood Street (A200). During the PM peak hour, a predominant southbound flow of 250 cycles was observed along Lower Road (A200).

12.4.66 Plough Way (B206) experiences a predominant westbound flow of 29 cycles in the AM peak hour and relatively balanced cycle flows of approximately five cycles in each direction during the PM peak hours.

*Traffic flows*

12.4.67 ATC data collected as part of the surveys have been analysed to identify the existing traffic flows along Lower Road (A200) and Evelyn Street (A200).

12.4.68 The weekday vehicle and HGV flows for a 12-hour period (07:00-19:00) shows that for Lower Road (A200) the busiest hour for northbound traffic is from 07:00 to 08:00 with a maximum of approximately 320 vehicles every 15 minutes and for the southbound direction, 18:00 to 19:00 is the busiest hour with approximately 260 vehicles every 15 minutes.

12.4.69 The weekday 07:00 to 08:00 is the busiest hour for Evelyn Street (A200) (northbound) with a maximum of approximately 280 vehicles every 15 minutes while for the southbound direction 18:00 to 19:00 is the busiest hour with approximately 250 vehicles every 15 minutes.

12.4.70 At the junction of Lower Road (A200) / Rotherhithe New Road (A2208) / Plough Way (B206), junction traffic surveys indicate that there is a total traffic flow of 1,127 and 1,859 vehicles in the AM and PM peak hours respectively using the junction of Lower Road (A200) and Plough Way (B206) with a predominant traffic flow along Lower Road (A200) in the southbound direction.

12.4.71 In the AM and PM peak hours, a total of 235 and 346 vehicles use Plough Way (B206) and Yeoman Street junction respectively, with a predominant westbound flow of 135 vehicles in the AM peak hour and predominant eastbound flow of 251 vehicles during the PM peak hour along Plough Way (B206).

12.4.72 The traffic flows for the busiest period within the area are shown in Vol 22 Figure 12.4.6 and Vol 22 Figure 12.4.7 (see separate volume of figures). Weekday flows are used as this is when the greatest impacts from the project are likely to be experienced.

*Parking*

12.4.73 Surveys were undertaken to establish the availability of resident, pay and display and unrestricted parking in the vicinity of the site to understand existing occupancy and capacity. Results indicate there is ample capacity in the area surrounding the site; spaces in these locations are not heavily used for the majority of the day.

### Local highway modelling

12.4.74 To establish the existing capacity on the local highway network, a scope was discussed with TfL and the LB of Lewisham to model the junction of Lower Road (A200), Plough Way (B206) and Rotherhithe New Road (A2208) using the LinSig model. The baseline model incorporates the current traffic and transport conditions within the vicinity of the site and follows the methodology outlined in Vol 2 Section 12.

12.4.75 The weekday AM, inter-peak, PM and weekend baseline model queues for Lower Road (A200), Plough Way (B206) and Rotherhithe New Road (A2008) were compared against observed queue lengths for the peak periods (from junction surveys) to validate the LinSig model and ensure reasonable representation of existing conditions.

12.4.76 Vol 22 Table 12.4.1 shows the modelling outputs for the baseline case for the junction of the Lower Road (A200), Plough Way (B206) and Rotherhithe New Road (A2208).

12.4.77 The modelling results indicate that the network is currently operating below theoretical capacity in the weekday AM and PM peak hours. The PM peak hour is the busiest and the Rotherhithe New Road (A200) westbound ahead movement is operating at 68% of saturation, with maximum queues of six vehicle lengths. The delay to vehicles is most significant during the PM peak hour on Plough Way (B206) for vehicles turning left and continuing ahead into Lower Road (A200) and Rotherhithe New Road (A2208), which currently experiences an average of 68 seconds of delay per PCU.

**Vol 22 Table 12.4.1 Transport – baseline LinSig model outputs**

| Approach | Movement | Weekday | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | AM peak hour (08:00-09:00) | | | | PM peak hour (17:00-18:00) | | | |
| | | Flow (PCU) | DoS | MMQ (PCU) | Delay (seconds per PCU) | Flow (PCU) | DoS | MMQ (PCU) | Delay (seconds per PCU) |
| Lower Road (A200) | Ahead / left | 363 | 21% | 2 | 4 | 934 | 51% | 4 | 5 |
| | Ahead / right | 667 | 44% | 3 | 5 | 850 | 54% | 4 | 5 |
| Plough Way (B206) | Ahead / left | 98 | 48% | 3 | 60 | 74 | 48% | 3 | 68 |
| Rotherhithe New Road (A2208) | Ahead | 306 | 51% | 3 | 7 | 409 | 68% | 6 | 11 |
| | | PRC | | Total delay (PCU hours) | | PRC | | Total delay (PCU hours) | |
| Overall junction performance | | +75% | | 4 | | +32% | | 5 | |

*Note: DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. Delay represents the mean delay per PCU. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 and pedal cycles are 0.2 PCUs.*

## Transport receptors and sensitivity

12.4.78 The receptors and their sensitivities in the vicinity of the Earl Pumping Station site are summarised in Vol 22 Table 12.4.2. The transport receptor sensitivity is defined as high, medium or low using the criteria detailed in Vol 2 Section 12.

12.4.79 The transport effects identified in this assessment are directly related to changes to the operation of transport networks which may occur as a result of physical changes to transport networks or of additional vessel or vehicle movements or additional public transport patronage. These changes in operation could lead to effects which would be experienced by people using those transport networks, whether as pedestrians, cyclists, public transport or private vehicle users. The assessment identifies several 'generic' groups of transport users in the list of transport receptors.

12.4.80 Receptors who are occupiers and users of or visitors to existing or committed developments in the vicinity of each of the project sites may experience transport effects on their journeys to and from those developments. In many cases those effects would be similar (or identical) to the effects identified for the 'generic' groups of transport users. However, the assessment specifically includes these receptors to ensure that any particular effects that they would be likely to experience (for instance because they make use of particular routes or transport facilities) have been identified.

**Vol 22 Table 12.4.2 Transport – receptors and sensitivity**

| Receptors (relating to all identified transport effects) | Phase at which receptor is sensitive to identified impacts | Value/sensitivity and justification |
|---|---|---|
| Pedestrians and cyclists (including sensitive pedestrians[iii]) using footways and roads immediately surrounding the site | Construction | High sensitivity to increased HGV traffic, footway closures and diversions resulting in increases to journey times |
| Private vehicle users in the area using the local highways or on-street parking | Construction<br>Operation | Medium sensitivity to increases in HGV traffic and changes to parking provision |
| Emergency vehicles travelling on roads in the immediate area | Construction<br>Operation | High sensitivity to journey time delays due to time constraints on journey purposes |

[iii] Sensitive pedestrians include those with mobility impairments, including wheelchair users.

| Receptors (relating to all identified transport effects) | Phase at which receptor is sensitive to identified impacts | Value/sensitivity and justification |
|---|---|---|
| Service vehicles using loading bay on Lower Road (A200) | Construction | Low sensitivity due to distance from the site |
| Bus users (passengers) travelling along Lower Road (A200) and Plough Way (B206) | Construction | Medium sensitivity to journey time delays as a result of increases in traffic flows and to patronage change |
| Public transport users using rail or river services within the area | Construction | Low sensitivity due to distance from the site and low numbers of construction workers |
| Residential properties on Croft Street, adjacent to the southern boundary of site | Construction | High sensitivity to increases in HGV traffic and changes to pedestrian environment resulting in journey time delays |
| Users of Surrey Docks Water Sports Centre,180m to north of site<br>Users of Theodorous South Dock Marina, 180m to northeast of site | Construction | Low sensitivity to changes to footways and highway operations |

## Construction base case

12.4.81 As described in Section 12.3 above, the construction assessment year for transport effects in relation to this site is Site Year 1 of construction.

12.4.82 There are no known proposals to change the pedestrian network by Site Year 1 of construction and the network would operate as indicated in the baseline situation. Cycle Superhighway Route 4 is a planned future route running between Woolwich and London Bridge which is expected to open by Site Year 1 of construction.

12.4.83 Due to the traffic growth in the construction base case compared to the baseline situation, bus journey times at the junction of Lower Road (A200) / Plough Way (B206) / Rotherhithe New Road (A2208) and within the wider area would be affected. However, the changes would be very small, representing an additional average delay of one second per PCU in the PM peak hour on the Lower Road (A200) southbound ahead and right movements, and the Rotherhithe New Road (A2208) westbound ahead movement, and no changes to average delay in the AM peak hour, compared to baseline conditions.

12.4.84 In terms of the public transport network, it is expected that as a result of the TfL *London Underground Upgrade Plan* (TfL, 2011)[7], compared to the current baseline there would be increase in capacity on the Jubilee Line of approximately 33% and a reduction in journey times of approximately 22%. It is envisaged that London Underground and London Overground patronage would also increase by the peak construction year.

12.4.85 In order to ensure that the busiest base case scenario is used in the assessment, the capacity for London Overground and London Underground in the base case has been assumed to remain the same as capacity in the baseline situation. This ensures a robust assessment as outlined in Vol 2 Section 12.

12.4.86 There are no known proposals to alter river passenger services from the current baseline conditions and therefore the construction base case remains similar to the baseline position.

12.4.87 Baseline traffic flows (from the junction surveys) have been used and forecasting carried out to understand the capacity on the highway network in the vicinity of the Earl Pumping Station site in Site Year 1 of construction without the Thames Tideway Tunnel project. The construction base case traffic flows (derived from the survey data) providing input to the LinSig model are shown on Vol 22 Figure 12.4.6 and Vol 22 Figure 12.4.7 (see separate volume of figures).

12.4.88 The key findings of the construction base case LinSig model for Earl Pumping Station indicate that there would be changes in queue lengths and to average delays at the junction of Lower Road (A200), Plough Way (B206) and Rotherhithe New Road (A2208) in the construction base case, compared to baseline conditions.

12.4.89 The results indicate that there would be an additional road network delay of a maximum of approximately one second in the PM peak hour on the Lower Road (A200) southbound ahead and right movements, and the Rotherhithe New Road (A2208) westbound ahead movement. In the AM peak hour, there would be no additional delay at Lower Road (A200) / Plough Way (B206) / Rotherhithe New Road (A2208) junction.

12.4.90 Results indicate that the local network would continue to operate below capacity, when taking into account the construction base case traffic flows.

12.4.91 The construction base case takes into account traffic growth and new developments described in Vol 22 Appendix N within the local area by Site Year 1 of construction. With regard to the identification of additional receptors associated with the other developments, the developments within 250m of the site which are fully/partially complete in Site Year 1 of construction are Tavern Quay and Cannon Wharf as detailed in Vol 22 Table 12.4.3.

12.4.92 Impacts could be experienced by residents, employees and visitors at these developments using the footways and the local highway network in the vicinity of the site and on this basis they have been taken into the consideration as receptors in the assessment.

**Vol 22 Table 12.4.3 Transport – construction base case additional receptors**

| Receptors (relating to developments within 250m of the site) | Phase at which receptor is sensitive to identified impacts | Value/sensitivity and justification |
|---|---|---|
| New residents and users of the mixed-use Cannon Wharf development, Evelyn Street (A200), 120m to south of site<br><br>New residents and users of the mixed-use Tavern Quay development, Rope Street, 150m to northeast of site | Construction | Medium sensitivity to increases in HGV traffic and changes to pedestrian environment resulting in journey time delays |

### Operational base case

12.4.93 The operational assessment year for transport is Year 1 of operation.

12.4.94 As explained in para. 12.1.4, the elements of the transport network that are assessed during operation are highway layout and operation. For the purposes of the operational base case, it is anticipated that the highway layout would be as indicated in the construction base case.

12.4.95 The operational base case takes into account the developments described in Vol 22 Appendix N. The development of Marine Wharf West, a new five storey building on Yeoman Street, and construction of buildings in Cannon Wharf and Tavern Quay are within 250m of the Earl Pumping Station site, and would be complete by Year 1 of operation. However, given the limited effects anticipated in the operational phase, these developments do not present any additional relevant transport receptors that require consideration in the operational effects assessment.

## 12.5 Construction effects assessment

12.5.1 This section summarises the findings of the assessment undertaken for the peak year of construction at the Earl Pumping Station site (Site Year 1 of construction).

12.5.2 The worker mode split has been derived by taking the highest number of workers during the peak month and calculating the percentage of trips by mode using the 2001 Census journey to work data for the area in the vicinity of the Earl Pumping Station site[iv]. The Census data indicates that the predominant mode of travel for journeys to work in this area is car. The mode split outlined in Vol 22 Table 12.5.1 has been used to assess the impacts of worker journeys on the highway and public transport networks.

12.5.3 However, it is noted that parking on surrounding streets is restricted, and measures to reduce car use would be incorporated into site-specific *Travel plan* requirements. Therefore the number of construction workers driving to the site would in reality be much lower.

**Vol 22 Table 12.5.1 Transport – mode split**

| Mode | Percentage of trips to site | Equivalent number of worker trips (based on 40 worker trips) | |
|---|---|---|---|
| | | AM peak hour (07:00-08:00) | PM peak hour (18:00-19:00) |
| Bus | 13% | 5 | 5 |
| Overground | 7% | 3 | 3 |
| Underground | 10% | 4 | 4 |
| Car driver | 52% | 21 | 21 |
| Car passenger | 3% | 1 | 1 |
| Cycle | 2% | <1 | <1 |
| Walk | 9% | 4 | 4 |
| River | 1% | <1 | <1 |
| Other (taxi/motorcycle) | 3% | 1 | 1 |
| **Total** | 100 | 40 | 40 |

## Pedestrian routes

12.5.4 The Construction phase (phase 1 and phase 2) plans (see separate volume of figures – Section 1) show the layout of the pedestrian footways during construction.

12.5.5 The footways bordering Earl Pumping Station along Croft Street and Yeoman Street would require closure and diversion during phases 1 and 2 of construction. Pedestrians would be diverted to the western footway of Croft Street and eastern footway of Yeoman Street.

12.5.6 During phase 2 of construction, parts of the southern footway of Chilton Grove would also require closure and pedestrians would be diverted to the northern footway of Chilton Grove.

[iv] Based on 2001 Census as this type of data had not been released from the 2011 Census at the time of assessment. .

12.5.7 To assess a busiest case scenario, it has been anticipated that all workers would finish their journeys by foot. As a result the 40 worker trips generated by the site have been added to the construction base case pedestrian flows during the AM and PM peak hours.

12.5.8 Existing pedestrian flows on Plough Way (B206) and other routes to the site are relatively low, and an additional 40 pedestrian trips could be accommodated within the capacity of the existing pedestrian network.

12.5.9 In determining the magnitude of impacts on pedestrian routes, the relevant impact criteria are accidents and safety, pedestrian delay and pedestrian amenity (as set out in Vol 2 Section 12).

12.5.10 It is anticipated that the pedestrian diversions around the Earl Pumping Station site would result in a journey time increase of approximately 30 seconds, due to the need for some pedestrians to cross Croft Street and Yeoman Street and extension of the journey by 32m in phase 1 and 48m in phase 2 of construction. This results in a negligible impact on pedestrian delay.

12.5.11 With regards to pedestrian amenity and accidents and safety, the closure of the footways on the south side of Chilton Grove, east side of Croft Street and west side of Yeoman Street would result in pedestrians having to make up to an additional two road crossings. However, in this location, pedestrian flows would be well below 240 persons per hour and the additional construction HGV flows would be between four and 20 movements per hour. Taking account of the range of criteria for pedestrian amenity and accidents and safety, the overall impact on these aspects has been assessed as low adverse.

### Cycle facilities and routes

12.5.12 The relevant impact criteria for determining the magnitude of impacts on cycle facilities and routes are cycle delay and accidents and safety (as set out in Vol 2 Section 12).

12.5.13 Cyclists using the local highway would experience an additional delay to journey time as a result of the construction works at the Earl Pumping Station site. The effect on journey times is outlined in the highway operation and network assessments (paras. 12.5.45 to 12.5.47) and would be a maximum increase of one second per PCU on the Lower Road (A200) southbound approach in the AM peak hour and a maximum of two seconds per PCU in the PM peak hour on the Plough Way (B206) westbound approach over that in the construction base case. This represents a negligible impact.

12.5.14 With regard to accidents and safety, while cyclists would not be required to make any additional road crossings, there would be an increase in construction traffic flow of greater than four two-way HGV movements per hour but less than 20 two-way HGV movements. This represents a low adverse impact.

### Bus routes and patronage

12.5.15 The relevant impact criteria with respect to the assessment of bus routes are road network delay and patronage (as set out in Vol 2 Section 12).

12.5.16 No bus services run immediately past the site. However, additional construction vehicles serving the site may affect bus journey times along Plough Way (B206), Lower Road (A200) and within the wider area. The effect on journey times is detailed under the highway operation and network assessment (paras. 12.5.45 to 12.5.47) and would result in a maximum road network delay of one second per PCU on the Lower Road (A200) southbound approach in the AM peak hour and a maximum of two seconds per PCU in the PM peak hour on the Plough Way (B206) westbound approach over that in the construction base case. This represents a negligible impact.

12.5.17 It is expected that approximately five additional two-way worker trips would be made by bus during the AM and PM peak hours, which would result in less than one worker trip per bus (based on a service of 49 buses during the AM and PM peak hours within a 640m walking distance).

12.5.18 Based on the impact criteria outlined in Vol 2 Section 12, the additional worker trips made by bus in peak hours would have a negligible impact on bus patronage.

### London Underground and London Overground and patronage

12.5.19 No underground or rail stations are directly adjacent to the site and therefore none would be directly affected by the construction site development. It is anticipated that approximately three construction workers would use London Overground services to access the site and four would use London Underground services.

12.5.20 On London Overground and London Underground services, these additional journeys equate to less than one additional person per train based on the frequency of services available in the vicinity of the site.

12.5.21 Based on the quantitative assessment of patronage and the impact criteria on rail patronage in Vol 2 Section 12, this would result in a negligible impact on London Overground and London Underground patronage.

### River passenger services and patronage

12.5.22 During construction, no river passenger services would be directly affected. It is anticipated that 1% of construction workers and labourers would use the river services to access the construction site, which would result in less than one additional journey per boat service. In accordance with the impact criteria for river patronage set out in Vol 2 Section 12, this would result in a negligible impact on river service usage.

### Parking

12.5.23 Parking for five essential maintenance vehicles would be provided on site. With regard to construction worker parking, measures would be taken for this site to discourage workers from travelling by car, including promoting the use of public transport, walking or cycling. These measures are included in the *Draft Project Framework Travel Plan*, which accompanies the application, and the *CoCP* Section 5. However, the 2001 census data has been used to provide a robust assessment of the effects that might arise if workers drive to this site and on that basis 21 workers could be expected to drive to the Earl Pumping Station site per day.

12.5.24 To accommodate construction vehicle access to the site, a resident parking bay with capacity for one vehicle on Croft Street would require temporary restriction during phase 1 of construction. This parking bay would be reinstated to its baseline condition following the completion of phase 1 of construction.

12.5.25 During phase 2 of construction, a resident parking bay with capacity for approximately seven vehicles on Chilton Grove would require temporary restriction. This parking bay would be reinstated to its baseline conditions following the completion of phase 2 of construction.

12.5.26 These resident parking bays are located in the LB of Southwark.

12.5.27 The unmarked kerbside parking along Yeoman Street to the south of the junction with Chilton Grove, and along Chilton Grove between the junctions with Yeoman Street and Croft Street would be restricted during phases 1 and 2 of construction. These unmarked kerbside parking spaces are located in the LB of Lewisham.

12.5.28 The proposed restriction of resident parking bays and the unmarked kerbside parking associated with the construction works at the Earl Pumping Station site is shown in the Highway layout during construction plans (see separate volume of figures – Section 1).

12.5.29 The temporary restriction of the resident parking bays and the unmarked kerbside parking along Chilton Grove, Croft Street and Yeoman Street has been discussed with the LB of Lewisham and the LB of Southwark. The spaces would not be reprovided as there is spare capacity currently shown to be available on the roads close to the site (see para. 12.4.73). It is also noted that residents living in one borough are not able to use resident parking bays in the adjacent borough, as permits are not transferable...

12.5.30 In determining the magnitude of impacts on parking, the relevant impact criterion is vehicle parking and loading changes (as set out in Vol 2 Section 12).

12.5.31 Although the construction work at Earl Pumping Station would require the restriction of one resident parking space along Croft Street and approximately seven resident parking spaces along Chilton Grove, there would still be more than sufficient spare capacity to accommodate this displacement. The changes required to parking provision would therefore result in a low adverse impact.

12.5.32 No changes are proposed to the loading bay on Lower Road (A200) and therefore there would be a negligible impact on users of this loading bay.

## Highway network and operation

12.5.33 The Highway layout during construction plans (see separate volume of figures – Section 1) show that the site would be accessed from Yeoman Street and exited onto Croft Street. The highway layout during construction vehicle swept path analysis plan (see Earl Pumping Station *Transport Assessment* Figures) demonstrates that the construction vehicles would be able to safely enter and leave the site.

12.5.34 In phase 2, a short-term lane closure on Chilton Grove outside the Earl Pumping Station access point would be required to make a connection to the existing sewer and undertake service diversion works. During this period temporary traffic management to maintain two-way operation would be required.

12.5.35 Speed cushions would also be removed temporarily on roads immediately surrounding the Earl Pumping Station for the duration of the construction works to accommodate construction vehicles arriving and departing the site. These comprise the temporary removal of three speed cushions along Croft Street (outside the site access point) during phase 1 of construction, and two along Chilton Grove during phase 2 of construction. During phase 1 of construction three new speed cushions would be installed to the south of the site access point on Croft Street to reduce vehicle speeds. The speed cushions on Croft Street would be reinstated at the end of phase 1 and those on Chilton Grove would be reinstated at the end of construction period.

12.5.36 Vehicle access to the site would take place from Yeoman Street with the egress point onto Croft Street and vehicle access would be arranged on a right-turn in / right-turn out basis.

12.5.37 Construction lorry movements would be limited to the day shift only (08:00 to 18:00 Monday to Friday and 08:00 to 13:00 Saturdays). In exceptional circumstances HGV and abnormal load movements could occur up to 22:00 on weekdays for large concrete pours and later at night on agreement with the LB of Lewisham.

12.5.38 Vol 22 Table 12.5.2 shows the construction lorry movement assumptions for the local peak traffic periods. These are based on the peak months of construction activity at this site. The assessment has been based on 10% of the daily number of lorry journeys occurring in the peak hours, which has been agreed with TfL as a reasonable approach. It is recognised that it may be desirable to reduce the number of construction lorry movements in peak hours and the mechanisms for addressing this would form part of the *Traffic Management Plans* which are required as part of the *Code of Construction Practice.*

**Vol 22 Table 12.5.2 Transport – peak construction works vehicle movements**

| Vehicle type | Vehicle movements per time period | | | | |
|---|---|---|---|---|---|
| | Total daily | 07:00 to 08:00 | 08:00 to 09:00 | 17:00 to 18:00 | 18:00 to 19:00 |
| Construction lorry vehicle movements 10%* | 68 | 0 | 7 | 7 | 0 |
| Other construction vehicle movements** | 36 | 4 | 4 | 4 | 4 |
| Worker vehicle movements*** | 42 | 21 | 0 | 0 | 21 |
| **Total** | **146** | **25** | **11** | **11** | **25** |

** The assessment has been based on 10% of the daily construction lorry movements associated with materials taking place in each of the peak hours.*
*** Other construction vehicle movements includes cars and light goods vehicles associated with site operations and contractor activity.*
****Worker vehicle numbers based on 52% of workers driving, derived by taking the highest number of workers during the peak month and calculating the % of trips using the 2001 Census Journey to Work data. This represents an unconstrained case, as there would be no parking on site for workers and the Draft Project Framework Travel Plan, which accompanies the application, will include measures to restrict workers from parking in surrounding streets.*

12.5.39 Assuming that all construction materials would be transported by road, an average peak flow of 146 vehicle movements a day is expected during the months of greatest activity during Site Year 1 of construction at this site. At other times in the construction period, vehicle flows would be lower than this average peak figure.

12.5.40 The relevant impact criteria for determining the magnitude of impacts on highway network and operation are accidents and safety, road network delay and hazardous loads (as set out in Vol 2 Section 12).

12.5.41 It is anticipated that the changes to highway layout would have a low adverse impact on accidents and safety as the average hourly construction HGV flow would be between four and 20 movements per hour and the site would not be accessed directly from a strategic road.

12.5.42 It is assessed that potentially one vehicle every fortnight would be transporting hazardous loads to and from this site during construction which equates to a low adverse impact.

12.5.43 The LinSig model has been used to apply the construction traffic demands to the construction base case to determine the changes in the operation of the highway network due to the project (ie, comparison of base and development cases). The development case traffic flows (providing input to the LinSig model) are shown on Vol 21 Figure 12.4.6 and Vol 21 Figure 12.4.7 (see separate volume of figures).

12.5.44 A summary of the construction assessment results for the weekday AM and PM peak hours is presented in Vol 22 Table 12.5.3 and Vol 22 Table 12.5.4.

12.5.45 The LinSig model results indicate that the construction works would not change the overall performance of the junction; however, they would produce a marginal increase in demand on some arms and there would be small changes to average delays on different arms of the junction.

12.5.46 The additional road network delay during the AM peak hour as a result of the construction traffic would be a maximum of one second per PCU on Lower Road (A200). The level of saturation of the Lower Road (A200) ahead and left movement would increase by 1%.

12.5.47 In the PM peak hour all arms would remain within capacity although Plough Way (B206) would experience an increase of 4% in the level of saturation. Vehicles using Plough Way (B206) would be delayed by an additional two seconds on average. Overall this would result in a negligible impact on highway network delay.

**Vol 22 Table 12.5.3 Transport – construction LinSig model outputs (AM peak hour)**

| Approach | Arm | Flow (PCU) | Weekday | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AM peak hour (08:00-09:00) | | | | | | | | |
| | | | DoS | | | MMQ (PCU) | | | Delay (seconds per PCU) | | |
| | | | Base case | Devt case | Change | Base case | Devt case | Change | Base case | Devt case | Change |
| Lower Road (A200) | Ahead / left | 395 | 22% | 23% | +1% | 2 | 2 | 0 | 4 | 5 | +1 |
| | Ahead / right | 677 | 45% | 45% | 0% | 3 | 3 | 0 | 5 | 6 | +1 |
| Plough Way (B206) | Ahead / left | 108 | 49% | 49% | 0% | 3 | 3 | 0 | 60 | 58 | -2 |
| Rotherhithe New Road (A2208) | Ahead | 316 | 53% | 53% | 0% | 4 | 4 | 0 | 7 | 7 | 0 |
| | | | PRC | | | | | | Total delay (PCU hours) | | |
| Overall junction performance | | | 70% | 70% | 0% | | | | 4 | 4 | 0 |

*Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. Delay represents the mean delay per PCU. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs. Thames Tideway Tunnel construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of two.*
*2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in para. 12.3.23.*

**Vol 22 Table 12.5.4 Transport – construction LinSig model outputs (PM peak hour)**

| Approach | Arm | Flow (PCU) | Weekday | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PM peak hour (17:00-18:00) | | | | | | | | |
| | | | DoS | | | MMQ (PCU) | | | Delay (seconds per PCU) | | |
| | | | Base case | Devt case | Change | Base case | Devt case | Chang e | Base case | Devt case | Change |
| Lower Road (A200) | Ahead / left | 894 | 50% | 50% | 0% | 4 | 4 | 0 | 5 | 5 | 0 |
| | Ahead / right | 967 | 62% | 62% | 0% | 7 | 7 | 0 | 6 | 6 | 0 |
| Plough Way (B206) | Ahead / left | 82 | 49% | 53% | +4% | 3 | 3 | 0 | 68 | 70 | +2 |
| Rotherhithe New Road (A2208) | Ahead | 425 | 71% | 71% | 0% | 7 | 7 | 0 | 12 | 12 | 0 |
| | | | PRC | | | | | | Total delay (PCU hours) | | |
| Overall junction performance | | | 27% | 27% | 0% | | | | 6 | 6 | 0 |

*Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. Delay represents the mean delay per PCU. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs. Thames Tideway Tunnel construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of two.*
*2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in para. 12.3.23.*

## Significance of effects

12.5.48 The significance of effects has been determined based on the transport impacts described above, considered in the context of the sensitivity of the receptors identified in Vol 22 Table 12.4.2 and Vol 22 Table 12.4.3.

12.5.49 Vol 22 Table 12.5.5 sets out the effects on each receptor in the vicinity of the site.

**Vol 22 Table 12.5.5 Transport – significance of effects during construction**

| Receptors (relating to all identified transport effects) | Significance of effect | Justification (receptor sensitivity and impacts) |
|---|---|---|
| Pedestrians and cyclists (including sensitive pedestrians) using footways and roads immediately surrounding the site | Minor adverse effect on pedestrians<br>Minor adverse effect on cyclists | **Pedestrians:**<br>• High sensitivity<br>• Negligible impact on pedestrian delay<br>• Low adverse impact on pedestrian amenity and accidents and safety<br>• Due to majority of impacts of low adverse magnitude, equates to minor adverse effect.<br>**Cyclists:**<br>• High sensitivity<br>• Negligible impact on cycle delay<br>• Low adverse impact on accidents and safety<br>• Combination of low adverse and negligible impacts equates to minor adverse effect. |
| Private vehicle users in the area using the local highways or on-street parking | Minor adverse effect on highway users<br>Minor adverse effect on parking users | **Highway users:**<br>• Medium sensitivity<br>• Negligible impact on road network delay<br>• Low adverse impact on accidents and safety and from hazardous loads<br>• Due to majority of |

| Receptors (relating to all identified transport effects) | Significance of effect | Justification (receptor sensitivity and impacts) |
|---|---|---|
| | | impacts of low adverse magnitude, equates to minor adverse effect.<br>**Parking users:**<br>• Medium sensitivity<br>• Low adverse impact on on-street parking<br>• Due to low adverse impact, equates to minor adverse effect. |
| Emergency vehicles travelling on roads in the immediate area | Minor adverse effect | • High sensitivity<br>• Negligible impact on road network delay<br>• Low adverse impact on accidents and safety and from hazardous loads<br>• Due to majority of impacts of low adverse magnitude, equates to minor adverse effect. |
| Service vehicles using loading bay on Lower Road (A200) | Negligible effect | • Low sensitivity<br>• Negligible impact on loading bay<br>• Due to negligible impact, equates to negligible effect. |
| Bus users (passengers) travelling along Lower Road (A200) and Plough Way (B206) | Negligible effect | • Medium sensitivity<br>• Negligible impact on road network delay and patronage<br>• Due to negligible impacts, equates to negligible effect. |
| Public transport users using rail or river services within the area | Negligible effect | • Low sensitivity<br>• Negligible impact on patronage |

| Receptors (relating to all identified transport effects) | Significance of effect | Justification (receptor sensitivity and impacts) |
|---|---|---|
| | | • Due to negligible impact, equates to negligible effect. |
| Residential properties on Croft Street | Minor adverse effect on pedestrians<br>Minor adverse effect on cyclists<br>Minor adverse effect on highway users<br>Minor adverse effect on parking users | **Pedestrians:**<br>• High sensitivity<br>• Negligible impact on pedestrian delay<br>• Low adverse impact on pedestrian amenity and accidents and safety<br>• Due to majority of impacts of low adverse magnitude, equates to minor adverse effect.<br>**Cyclists:**<br>• High sensitivity<br>• Negligible impact on cycle delay<br>• Low adverse impact on accidents and safety<br>• Combination of low adverse and negligible impacts equates to minor adverse effect.<br>**Highway users:**<br>• High sensitivity<br>• Negligible impact on road network delay<br>• Low adverse impact on accidents and safety and from hazardous loads<br>• Due to majority of impacts of low adverse magnitude, equates to minor adverse effect.<br>**Parking users:**<br>• High sensitivity<br>• Low adverse impact on |

| Receptors (relating to all identified transport effects) | Significance of effect | Justification (receptor sensitivity and impacts) |
|---|---|---|
| | | on-street parking<br>• Due to low adverse impact, equates to minor adverse effect. |
| New residents and users of Cannon Wharf development<br>New residents and users of Tavern Quay development | Minor adverse effect on pedestrians<br>Minor adverse effect on cyclists<br>Minor adverse effect on highway users<br>Minor adverse effect on parking users | **Pedestrians:**<br>• Medium sensitivity<br>• Negligible impact on pedestrian delay<br>• Low adverse impact on pedestrian amenity and accidents and safety<br>• Due to majority of impacts of low adverse magnitude, equates to minor adverse effect.<br>**Cyclists:**<br>• Medium sensitivity<br>• Negligible impact on cycle delay<br>• Low adverse impact on accidents and safety<br>• Combination of low adverse and negligible impacts equates to minor adverse effect.<br>**Highway users:**<br>• Medium sensitivity<br>• Negligible impact on road network delay<br>• Low adverse impact on accidents and safety and from hazardous loads<br>• Due to majority of impacts of low adverse magnitude, equates to minor adverse effect.<br>**Parking users:**<br>• Medium sensitivity |

| Receptors (relating to all identified transport effects) | Significance of effect | Justification (receptor sensitivity and impacts) |
|---|---|---|
| | | • Low adverse impact on on-street parking<br>• Due to low adverse impact, equates to minor adverse effect. |
| Users of Surrey Docks Water Sports Centre<br>Users of Theodorous South Dock Marina | Negligible effect on pedestrians<br>Negligible effect on cyclists<br>Negligible effect on highway users<br>Negligible effect on parking users | **Pedestrians:**<br>• Low sensitivity<br>• Negligible impact on pedestrian delay<br>• Low adverse impact on pedestrian amenity and accidents and safety<br>• Given low sensitivity of receptors, impact magnitudes equate to negligible effect.<br>**Cyclists:**<br>• Low sensitivity<br>• Negligible impact on cycle delay<br>• Low adverse impact on accidents and safety<br>• Given low sensitivity of receptors, impact magnitudes equate to negligible effect.<br>**Highway users:**<br>• Low sensitivity<br>• Negligible impact on road network delay<br>• Low adverse impact on accidents and safety and from hazardous loads<br>• Given low sensitivity of receptors, impact magnitudes equate to negligible effect.<br>**Parking users:** |

| Receptors (relating to all identified transport effects) | Significance of effect | Justification (receptor sensitivity and impacts) |
|---|---|---|
| | | • Medium sensitivity<br>• Low adverse impact on on-street parking<br>• Given low sensitivity of receptors, impact magnitudes equate to negligible effect. |

## Sensitivity test for programme delay

12.5.50 The assessment has been based on an estimated programme for the construction of the Thames Tideway Tunnel project. That programme has been used to derive construction vehicle numbers and to understand the relationships between the project and other developments in the vicinity of project sites, in order to allow appropriate receptors to be identified.

12.5.51 If the overall programme were to be delayed by approximately a year, the implications in relation to the transport effects would be as follows:

a. It is unlikely that the effects on pedestrians and cyclists would change. Over the course of one year, it is unlikely that pedestrian or cycle traffic in the vicinity of the project site would increase by a sufficient amount to change the magnitude of impacts or the significance of effects reported, nor that the arrangements for pedestrian route diversions, would be any different to those currently proposed

b. Effects on public transport are unlikely to change as the rate of public transport patronage growth is relatively low and over the course of one year, any reduction in spare capacity on existing public transport networks would be small. Additionally, there is a general trend towards the enhancement of the public transport network through the provision of additional bus, rail and river services in order to meet future demand and accommodate future patronage growth. The transport assessment typically indicates that the additional public transport patronage arising from Thames Tideway Tunnel sites would be small and not significant in the context of the capacity available on the wider networks

c. Effects on the operation of the highway network are derived from the use of the TfL Highway Assignment Models (HAMs), which have a forecast model year of 2021. To provide consistency within the assessment, it has been agreed with TfL that this is an appropriate approach. Since the local highway capacity models for the base case also use traffic flow information from the HAMs, it follows that both the strategic and local capacity assessments are effectively based on a year of 2021. As the peak months of activity at the Earl Pumping Station site fall before 2021 based on the programme that has been assessed, it follows that a delay of up to one year would not alter the outcomes of the highway network modelling and therefore would not alter the effects reported

d. Based on the Development Schedule (see Vol 22 Appendix N), it is possible that as a result of a one year delay, some developments which have been assumed to be under construction in this assessment (Cannon Wharf, Yeoman Street, Marine Wharf West, Oxestalls Road, Convoys Wharf and Surrey Canal Triangle developments) would be partially complete and occupied. However, it is not expected that new receptors would experience any different effects to those receptors which have been assessed above; rather it would be a case of the potential for some additional receptors to experience the same effects that have already been identified.

## 12.6 Operational effects assessment

12.6.1 This section summarises the findings of the assessment undertaken for Year 1 of operation at the Earl Pumping Station site.

12.6.2 The transport demands created by the development in the operational phase would be extremely low and limited to occasional maintenance visits every three to six months, with certain instances where larger cranes and associated support vehicles may be required for access to the drop shaft and tunnel every ten years.

12.6.3 The assessment of the operational phase is therefore limited to the physical issues associated with accessing the site from the highway network as outlined in Section 12.2. This assessment approach has been discussed with the LB of Lewisham and TfL.

12.6.4 The operational assessment has taken into consideration those elements that would be affected, which comprise the short-term impacts on the highway layout and operation when maintenance visits are made to the site.

### Highway layout and operation

12.6.5 During the operational phase, the site would be accessed from Croft Street or via the existing Pumping Station access point on Yeoman Street and Chilton Grove. The permanent Highway layout plan (see separate volume of figures – Section 1) shows the highway layout during operational phase at the Earl Pumping Station site.

12.6.6 For routine three or six monthly inspections vehicular access would be required for light commercial vehicles, typically a transit van. On occasion there may be a need for small flatbed vehicles to access the site.

12.6.7 During ten-yearly inspections, space to locate two large cranes within the site area would be required. The cranes would facilitate lowering and recovery of tunnel inspection vehicles and to provide duty/standby access for personnel. To assess the effect of these on the highway layout, swept paths have been undertaken for the largest vehicles including 11.36m mobile cranes, 10m rigid articulated vehicle and 10.7m articulated vehicle. The permanent highway layout vehicle swept path analysis plan (see Earl

Pumping Station *Transport Assessment* Figures) demonstrates the swept path movements during operation and shows that the maintenance vehicles are able to safely enter and leave the site.

12.6.8 When larger vehicles are required to service the site, there may be some temporary, short-term delay to other road users while manoeuvres are made. However, it is anticipated that the arrival of large vehicles would normally be scheduled to take place outside of the peak hours to minimise the effect on the local highway network.

12.6.9 In accordance with the criteria outlined in Vol 2 Section 12, during the routine inspections of the operational site there would be a negligible impact on road network delay.

12.6.10 Taking into consideration the various sensitivities of the receptors affected during the operational phase (private vehicle users and emergency vehicles), this would result in a **negligible** effect on highway layout and operation.

### Sensitivity test for programme delay

12.6.11 If the opening year of the Thames Tideway Tunnel project were to be delayed by approximately one year, the results of the operational assessment would not be materially different to the assessment findings reported above.

## 12.7 Cumulative effects assessment

### Construction effects

12.7.1 Paras. 12.3.6 to 12.3.8 discuss the status of other developments in the area surrounding the Earl Pumping Station by Site Year 1 of construction. However, there are no specific cumulative effects to assess as the TfL Highway Assignment Models (HAM) have been developed using GLA employment and population forecasts, which are based on the employment and housing projections set out in the *London Plan 2011* (GLA, 2011)[8]. As a result, the assessment inherently takes into account a level of future growth and development across London. Therefore, the effects on transport would remain as described in Section 12.5. This would also be the case if the programme for the Thames Tideway Tunnel project were delayed by approximately one year.

### Operational effects

12.7.2 As indicated in the Development Schedule (see Vol 22 Appendix N), all the developments would be complete and operational by Year 1 of operation with the exception of the Surrey Canal Triangle development for which phase 5 would still be under construction. However, there is no need for a cumulative assessment on transport and the effects would remain as described in Section 0 above. This would also be the case if the programme for the Thames Tideway Tunnel project were delayed by approximately one year.

## 12.8 Mitigation

12.8.1 The project has been designed to limit the effects on transport networks as far as possible and many measures have been embedded directly in the design of the project, including in the *CoCP* Section 5 and *Draft Project Framework Travel Plan*. No additional measures are required for transport and therefore there is no mitigation identified for either construction or operation.

## 12.9 Residual effects assessment

### Construction effects

12.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 12.5. All residual effects are presented in Section 12.10.

### Operational effects

12.9.2 As no mitigation measures are proposed, the residual operational effects remain as described in Section 0. All residual effects are presented in Section 12.10.

## 12.10 Assessment summary

**Vol 22 Table 12.10.1 Transport – summary of construction assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Pedestrians and cyclists (including sensitive pedestrians) using footways and roads immediately surrounding the site | • Pedestrian diversion routes<br>• Movement of large construction vehicles<br>• Slight increased journey time for cyclists | Minor adverse effect on pedestrians<br>Minor adverse effect on cyclists | None | Minor adverse effect on pedestrians<br>Minor adverse effect on cyclists |
| Private vehicle users in the area using the local highways or on-street parking | • Movement of large construction vehicles<br>• Temporary lane closure on Chilton Grove<br>• Slight delay to journey time<br>• Temporary restriction of on-street parking bays | Minor adverse effect on highway users<br>Minor adverse effect on parking users | None | Minor adverse effect on highway users<br>Minor adverse effect on parking users |
| Emergency vehicles travelling on roads in the immediate area | • Movement of large construction vehicles<br>• Slight delay to journey time | Minor adverse effect | None | Minor adverse effect |
| Service vehicles using loading bay on Lower | • No effect on loading | Negligible effect | None | Negligible effect |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Road (A200) | bay | | | |
| Bus users (passengers) travelling along Lower Road (A200) and Plough Way (B206) | • Movement of large construction vehicles<br>• Slight delay to journey time<br>• Some additional patronage from construction workers | Negligible effect | None | Negligible effect |
| Public transport users using rail or river services within the area | • Some additional patronage from construction workers | Negligible effect | None | Negligible effect |
| Residential properties on Croft Street<br>Residents and users of Cannon Wharf development<br>Residents and users of Tavern Quay development | • Movement of large construction vehicles<br>• Pedestrian diversion routes<br>• Slight delay to journey time<br>• Temporary restriction of on-street parking bays | Minor adverse effect on pedestrians<br>Minor adverse effect on cyclists<br>Minor adverse effect on highway users<br>Minor adverse effect on parking users | None | Minor adverse effect on pedestrians<br>Minor adverse effect on cyclists<br>Minor adverse effect on highway users<br>Minor adverse effect on parking users |
| Users of Surrey Docks Water Sports Centre<br>Users of Theodorous South Dock Marina | • Movement of large construction vehicles<br>• Pedestrian diversion routes<br>• Slight delay to journey time | Negligible effect on pedestrians<br>Negligible effect on cyclists<br>Negligible effect on highway users | None | Negligible effect on pedestrians<br>Negligible effect on cyclists<br>Negligible effect on highway users |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| | • Temporary restriction of on-street parking bays | Negligible effect on parking users | | Negligible effect on parking users |

**Vol 22 Table 12.10.2 Transport – summary of operational assessment**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Private vehicle users in the area using the local highways or on-street parking | • Occasional delay to road users when large maintenance vehicles accessing the site | Negligible effect | None | Negligible effect |
| Emergency vehicles travelling on roads in the immediate area | • Occasional maintenance trips resulting in some temporary, short-term road network delay | Negligible effect | None | Negligible effect |

# References


[1] Defra, *National Policy Statement for Waste Water,* 2012.

[2] Transport for London, *Travel Planning for new development in London*, 2011.

[3] Transport for London, *Assessment Tool for Travel Plan Building Testing and Evaluation (ATTrBuTE)*, 2011. http://www.attrbute.org.uk/

[4] Thames Water. *EIA Scoping Report* (2011). Available at: http://www.thamestunnelconsultation.co.uk/document-library/catalogue-view/?c=4-eia-scoping-report

[5] Greater London Authority, *London Plan*, July 2011.

[6] Transport for London, *Transport Assessment Best Practice Guidance*, April 2010.

[7] Transport for London, *London Underground Upgrade Plan*, 2011. http://www.tfl.gov.uk/assets/downloads/corporate/our-upgrade-plan-london-underground-february-2011.pdf

[8] Greater London Authority, 2011. See citation above.

**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 13: Water resources - groundwater

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

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Creating a cleaner, healthier River Thames

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 13: Water resources – groundwater

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# 13 Water resources – groundwater

## 13.1 Introduction

13.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on groundwater at Earl Pumping Station.

13.1.2 The proposed development has the potential to affect groundwater due to:

a. dewatering of aquifer units

b. use of grouts/ground treatment to control ingress of water

c. creation of pathways for pollution

d. obstruction to groundwater flows

e. seepage into and out of the CSO drop shaft during operations.

13.1.3 The groundwater assessment at this site should be read in conjunction with the supporting Vol 22 Appendix K (K.1 – K.9) and the land quality assessment (Vol 22 Section 8 Land quality).

13.1.4 The site is underlain by a principal aquifer [i], the Chalk, and has no thick covering of impermeable material. Historically this part of east London has had a number of potentially polluting activities which may already have reduced the value/sensitivity of certain receptors. Included in this assessment are the impacts from other Thames Tideway Tunnel project sites which may have effects locally around Earl Pumping Station, for example dewatering at other Thames Tideway Tunnel project sites may draw down groundwater levels ahead of construction taking place at Earl Pumping Station.

13.1.5 An assessment of project-wide environmental effects on groundwater is presented in Volume 3 Project-wide assessment.

13.1.6 The assessment of groundwater presented in this section has considered the requirements of the National Policy Statement for Waste Water (Defra , 2012)[1] Section 4.2. The physical characteristics of the groundwater environment including groundwater resources and quality are presented and the anticipated effects (including cumulative effects) on these resources addressed in the assessment that follows (further detail can be found in Vol. 2 Section 13.3).

13.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

[i] Principal aquifer – a geological stratum that exhibits high inter-granular and /or fracture permeability (was previously referred to as a major aquifer)

## 13.2 Proposed development relevant to groundwater

13.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to groundwater are set out below.

### Construction

13.2.2 The elements of construction at the Earl Pumping Station site, relevant to groundwater, would include:

a. A drop shaft of approximately 17m internal diameter (ID), and approximately 47m deep (or 54.08mATD[ii] based on an assumed ground level of 101.4mATD) (excluding a 3m thick base slab once constructed). The shaft would have a secondary in situ concrete lining. No tunnelling excavation works are required as the Earl Pumping Station site is online to the Greenwich Connection Tunnel and the Tunnel Boring Machine (TBM) would break into the drop shaft and be re-launched towards the next CSO site.

b. An interception chamber to the existing combined sewer overflow (CSO) and other near ground structures for ventilation and controls.

c. A connection culvert from the interception chamber to the drop shaft.

13.2.3 The proposed methods of construction for these elements of the site are described in Section 3 of this volume and summarised in Vol 22 Table 13.2.1. Approximate duration of construction and depths are also contained in this table.

**Vol 22 Table 13.2.1 Groundwater – methods of construction**

| Design element | Method of construction | Construction periods (years)* | Construction depth (mbgl)** |
|---|---|---|---|
| CSO drop shaft | Diaphragm wall[iii] with internal dewatering | 1 | Deep |
| Interception chamber and connection culvert | Secant piles with permeation or jet grouting[iv] and internal dewatering | 1 | Deep<br>(up to 20) |

[ii] In general, the measurements of depth are expressed as metres Above Tunnel Datum (mATD). The standard zero point for mATD scale is -100maOD (metres above Ordnance Datum is based on Newlyn datum point for mean sea level). The use of the mATD scale avoids the need for use of negative values, and is widely used for large scale sub-surface projects.

[iii] Diaphragm wall - a sub-surface barrier installed around construction works to support the required excavation and which amongst other things helps to control inflows of groundwater typically formed of reinforced concrete. This barrier would extend down by up 8m below the base of the shaft invert, for structural reasons and to increase the length of the flow path and hence reduce the amount of groundwater inflows

[iv] Grouting - a thin, coarse mortar injected into various narrow cavities or voids , such as rock fissures, to fill them and consolidate the adjoining objects into a solid mass and to eliminate water.

| Design element | Method of construction | Construction periods (years)* | Construction depth (mbgl)** |
|---|---|---|---|
| Tunnel receipt / launch | Break in / out of CSO drop shaft by TBM and with ground treatment | <1 | Deep |

** The site would be used for construction purposes for up to 4 and a half years*
*** In terms of construction depth: Deep >10m.*

### Code of Construction Practice

13.2.4 All works would be undertaken in accordance with the *Code of Construction Practice (CoCP)*. The CoCP is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B). Relevant measures included within the *CoCP* Part A to ensure that adverse effects on groundwater are minimised as follows:

a. Measures include providing bunded stores for fuel/oils held on site and the settlement of dewatering water from excavations to prevent silty water from entering watercourses, surface water drains and onto roads as per Environment Agency (EA) guidelines (EA, 2011a)[2]. The contractor would have plans and equipment in place to deal with emergency situations as well as ensuring that staff are appropriately trained.

b. A precautionary approach, involving targeted risk-based audits and checks of water quality monitoring, would be applied to licensed abstractions and unlicensed abstractions thought to be at risk.

c. Monitoring arrangements for dewatering permits and any permits required on change of licensing regulations would be developed in liaison with the EA (see also the groundwater monitoring strategy Vol 3, Appendix K.1).

d. The use of any materials for ground treatment would be agreed with the EA prior to use.

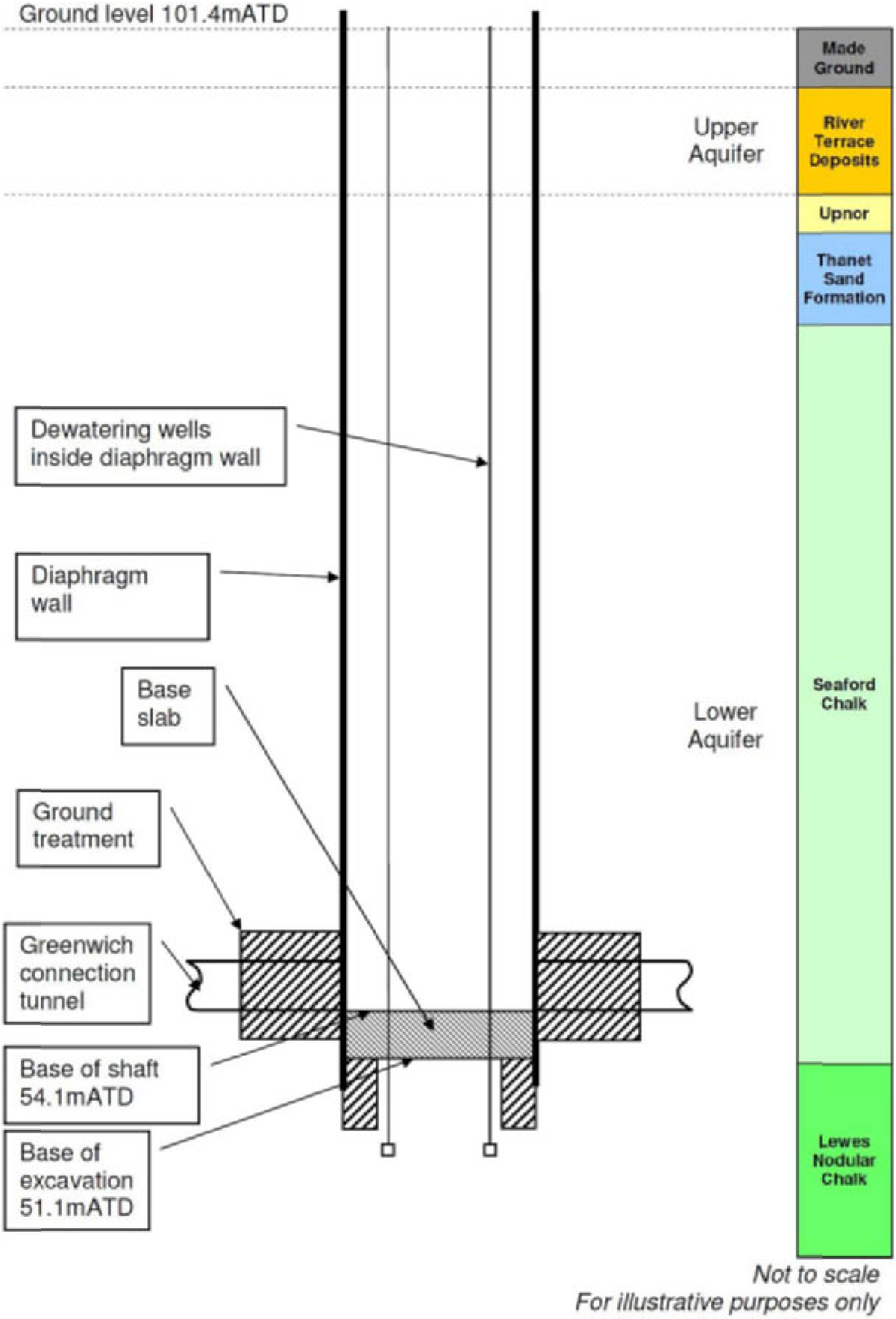
e. At the end of construction where temporary support does not form part of the operational structure it would be removed, piped through or cut down to avoid the build up of groundwater on the upstream side of underground structures.

13.2.5 There are no site specific groundwater measures contained within the *CoCP Part B*.

### Other measures during construction

13.2.6 The depth of the CSO drop shaft and invert level means that it would extend into the Seaford Chalk (see Vol 22 Table 13.4.1 and Vol 22 Appendix K.1), which is expected to contain substantial quantities of groundwater. The method of construction for the CSO drop shaft would involve building a concrete barrier around the shaft (a diaphragm wall) (see Vol 22 Plate 13.2.1). This method would reduce the amount of pumping required from within the diaphragm wall. There would be no pumping external to the diaphragm wall. This should ensure that any movement of the known contamination beneath the site (see Section 13.4) is minimised as a result of pumping. The periods when pumping would be required would be during construction of the CSO drop shaft (approximately 12 months) and for the break into/out of the CSO drop shaft for the tunnel boring machine in the Greenwich connection tunnel (approximately 6 months).

**Vol 22 Plate 13.2.1 Groundwater – schematic of a diaphragm wall with internal dewatering**



13.2.7 The water levels outside the diaphragm wall would be drawn down by only a few centimetres, due to the barrier effects. An estimate of the amount of dewatering needed at Earl Pumping Station site is less than 200$m^3$/d. This relatively small volume is due to the method proposed to construct the CSO drop shaft.

13.2.8 For the construction of the interception chamber and connection culvert, secant piles[v] would be installed to just short of the existing sewer (to around 11mbgl) to minimise groundwater ingress, at other points on site the secant piles would be deeper to around 18 to 20m. Ground treatment such as grouting is likely to be required to further reduce inflows to the construction area. Localised dewatering within the piled walls would be required to manage groundwater ingress from the upper and lower aquifers. Groundwater would be discharged directly to an appropriate sewer on the site, following any necessary treatment and subject to EA. The duration of pumping for the interception chamber and connection culvert would be determined by ground conditions but could be up to 12 months.

13.2.9 Around the base of the drop shaft, a block approximately 5m high with a width of 1.5m would be grouted[vi] for the full circumference of the drop shaft. In addition, the break into/out of the CSO drop shaft for the tunnel boring machine in the Greenwich Connection Tunnel is expected to require ground treatment either side of the shaft. The dimensions of the two blocks which would require ground treatment would be approximately 10m by 10m and extending 15m from the shaft into the Chalk. Any grouting products used would be approved by the EA.

### Operation

13.2.10 A groundwater monitoring strategy is one of the project's environmental design measures (see Vol 3 Appendix K.1). This covers groundwater levels and groundwater quality and outlines the future monitoring and actions in the event of trigger levels being exceeded

## 13.3 Assessment methodology

### Engagement

13.3.1 Vol 2 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. There have been no site specific comments relevant to the Earl Pumping Station site for the assessment of groundwater.

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[v] Secant piles – a sub-surface barrier installed around construction sites in order to control inflows of shallow groundwater typically formed of intersecting concrete or overlapping shafts of concrete.

[vi] Grouting - a thin, coarse mortar poured into various narrow cavities, such as rock fissures, to fill them and consolidate the adjoining objects into a solid mass.

### Baseline

13.3.2 The baseline methodology follows the methodology described in Vol 2. There are no site-specific variations for identifying the baseline conditions for this site.

13.3.3 The baseline describes receptors within a 1km radius of the combined sewer overflow (CSO) sites during both construction and operation.

13.3.4 The effects on groundwater may however extend beyond a kilometre depending on the hydrogeological setting and the method of construction used. These effects are considered to be of wider regional significance and are assessed in the project-wide assessment (see Vol 3).

### Construction

13.3.5 The assessment methodology for the construction phase follows that described in Vol 2. There are no site-specific variations for undertaking the construction assessment of this site.

13.3.6 The assessment year applied to the construction assessment is Site Year 1 of construction, when dewatering would first take place within the diaphragm wall at Earl Pumping Station. The baseline is not anticipated to change substantially between 2011 and Site Year 1 of construction (2017) and so baseline data from 2011 have formed the basis (base case) for the construction assessment.

13.3.7 A number of proposed developments which are likely to be complete and operational before commencement of construction have formed part of the construction base case.

13.3.8 The developments considered as part of the base case and those included in the cumulative effects assessment are presented in Vol 22 Table 13.3 1. The developments relevant to groundwater include basements, ground source heat pumps (GSHPs) and Sustainable Drainage Systems (SuDS).

**Vol 22 Table 13.3 1 Groundwater – construction base case and cumulative assessment developments (2017)**

| Development | Component or receptor relevant to groundwater | Construction base case | Cumulative impact assessment | Comments (if required) |
|---|---|---|---|---|
| Yeoman Street | Basement* | ✘ | ✓ | N/a |
| Marine Wharf West, Plough Way | Basement* | ✘ | ✓ | N/a |
| Tavern Quay Commercial Centre, Rope Street | Basement* | ✓ | ✘ | N/a |
| Cannon Wharf, 35 Evelyn Street | Basement* | Blocks B1, B2, B3, B4, C1, C2, C3, G, H, J and Business Centre complete | Blocks A, B5, C4, D1, D2, D3, E, F and Family Accommodation under construction. | N/a |
| Surrey Quays Leisure Site | Basement* | ✓ | ✘ | N/a |
| Canada Water, Surrey Quays Road Site A | Basement* | ✓ | ✘ | Abstraction **28/39/42/0048 already considered in current baseline |
| Canada Water, Surrey Quays Road Site C | Basement* | ✓ | ✘ | Abstraction **28/39/42/0048 already considered in current baseline |
| Oxestalls Road | Basement* SuDS* | ✘ | ✓ | N/a |
| Quebec Way Industrial Estate | Basement* | ✓ | ✘ | N/a |
| Mulberry Business Park Scheme | Basement* | ✓ | ✘ | N/a |
| Surrey Canal Triangle | Basement* GSHP** SuDS* | Phase 1A & 1B complete | Phase 2 under construction | N/a |
| Convoys Wharf | Basement* | ✘ | Phases 1 & 2 under construction | N/a |

** Relevant to the upper aquifer*
*** Relevant to the lower aquifer*
*Symbols ✓ applies ✘ does not apply*

13.3.9 Section 13.5 details the likely significant effects arising from the construction at the Earl Pumping Station site. Other nearby Thames Tideway Tunnel project sites which could give rise to additional effects on groundwater resources are Blackfriars Bridge Foreshore and Kirtling Street. These Thames Tideway Tunnel project sites are therefore included in the assessment of the impact of dewatering on the lower aquifer and licensed abstractions at the Earl Pumping Station, following the methodology set out in Vol 2 Section 12.

## Operation

13.3.10 The assessment methodology for the operational phase follows that described in Vol 2. There are no site-specific variations for undertaking the operational assessment of this site.

13.3.11 The assessment year applied to the operational assessment is Year 1 of operation. The baseline is not anticipated to vary significantly before the start of the operational phase in 2023; and therefore, baseline data from 2011 has formed the basis for the operational assessment. In addition, information on proposed development schemes likely to have been completed before commencement of the operation of the Thames Tideway Tunnel project has formed the operational base case.

13.3.12 The developments considered as part of the operational base case and cumulative effects assessment are included in Vol 22 Table 13.3.2. The developments relevant to groundwater are those which would contain basements, ground source heat pumps (GSHPs) and Sustainable Drainage Systems (SuDS).

**Vol 22 Table 13.3.2 Groundwater – operational base case and cumulative assessment developments (2023)**

| Development | Component or receptor relevant to groundwater | Construction base case | Cumulative impact assessment | Comments (if required) |
|---|---|---|---|---|
| Yeoman Street | Basement* | ✓ | ✗ | N/a |
| Marine Wharf West, Plough Way | Basement* | ✓ | ✗ | N/a |
| Tavern Quay Commercial Centre, Rope Street | Basement* | ✓ | ✗ | N/a |
| Cannon Wharf, 35 Evelyn Street | Basement* | ✓ | ✗ | N/a |
| Surrey Quays Leisure Site | Basement* | ✓ | ✗ | N/a |

| Development | Component or receptor relevant to groundwater | Construction base case | Cumulative impact assessment | Comments (if required) |
|---|---|---|---|---|
| Canada Water, Surrey Quays Road Site A | Basement* | ✓ | ✗ | Abstraction **28/39/42/0048 already considered in current baseline |
| Canada Water, Surrey Quays Road Site C | Basement* | ✓ | ✗ | Abstraction **28/39/42/0048 already considered in current baseline |
| Oxestalls Road | Basement* SuDS* | ✓ | ✗ | N/a |
| Quebec Way Industrial Estate | Basement* | ✓ | ✗ | N/a |
| Mulberry Business Park Scheme | Basement* | ✓ | ✗ | N/a |
| Surrey Canal Triangle | Basement* GSHP** SuDS* | Phase 1A, 1B, 2, 3 & 4 complete | Phase 5 under construction | N/a |
| Convoys Wharf | Basement* | ✓ | ✗ | N/a |

** Relevant to the upper aquifer*
*** Relevant to the lower aquifer*
*Symbols ✓ applies ✗ does not apply*

13.3.13 Section 13.6 details the likely significant effects arising from the operation at the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on groundwater resources within the assessment area for this site during the operational phase and so no other Thames Tideway Tunnel project sites are considered in this assessment.

## Assumptions and limitations

### Assumptions

13.3.14 The construction assumptions relevant to this site are presented in Section 13.2.

13.3.15 The assessment of dewatering in Section 13.5 is based on a quantitative assessment of dewatering on the lower aquifer using the best available hydraulic property information from the EA's London Basin groundwater model. The hydraulic properties for the Chalk obtained from this model, were an average transmissivity value of approximately 10m$^2$/d (EA and

ESI, 2010)[3] and a storativity[vii] value of approximately 1 x$10^{-4}$ at the Earl Pumping Station site (see Vol 2 Section 13).

13.3.16 The amount of pumping required from within the diaphragm wall at the Earl Pumping Station site is assumed to be less than 200$m^3$/d.

13.3.17 The assessment of obstruction effects in Sections 13.5 and 13.6 is based on estimated hydraulic gradient[viii] of 0.004 in the upper aquifer across the site.

13.3.18 The upper aquifer is assumed to be in hydraulic continuity with the overlying layers, Alluvium and Made Ground.

13.3.19 Hydraulic continuity between the upper and lower aquifers is likely at the Earl Pumping Station site.

13.3.20 The regional groundwater flow direction in the Chalk was based on the EA groundwater contour map (EA, 2011b)[4] and this indicates flow towards the northwest.

13.3.21 This assessment has assumed that the shaft would have a design criterion to limit the rate of seepage of 1l/$m^2$/d (see Vol 2 Appendix K.3).

13.3.22 The measurements of the depth of shafts are quoted to two decimal places, however these measurements may be altered slightly in the future and are therefore indicative only

13.3.23 For the purposes of this assessment, deep refers to greater than 10m below ground level (bgl).

13.3.24 For the purposes this assessment, it is assumed that non-infiltration type SuDS will be used on any neighbouring developments which take place locally.

### Limitations

13.3.25 No site-specific pumping tests have yet been undertaken as part of the ground investigation. In the absence of site-specific hydrogeological data, published sources of hydrogeological information have been used in this assessment (see Vol 22 Appendix K.2).

13.3.26 The range of hydrological conditions experienced during the monitoring period (2010-2012) did not include a prolonged wet winter period when exceptionally high groundwater levels might occur.

13.3.27 Despite the limitations identified above, the assessment, which uses the best available information is considered robust.

## 13.4 Baseline conditions

13.4.1 The following section sets out the baseline conditions for groundwater within and around the site. Future baseline conditions (base case) are also described.

[vii] Storativity – the volume of water released for a unit change in water level (in a confined aquifer)

[viii] Hydraulic gradient – the slope of the water table which drives groundwater movement

13.4.2 This section of the assessment is supported by Vol 22 Appendix K.1 – K.9.

## Current baseline

### Hydrogeology

13.4.3 The drop shaft would pass through Superficial Deposits/Made Ground, Alluvium, River Terrace Deposits, Upnor Formation, Thanet Sands and Seaford Chalk. The superficial and solid geology in the vicinity of the site, as published by the British Geological Survey (BGS, 2009)[5], is shown in Vol 22 Figure 13.4.1 and Vol 22 Figure 13.4.2 respectively (see separate volume of figures).

13.4.4 The River Terrace Deposits forms the upper aquifer and is classified by the EA as a secondary A aquifer[ix]. The Upnor Formation, Thanet Sands (both classified as secondary aquifers by the EA) and Chalk (classified as a principal aquifer by the EA) form the lower aquifer, although the Upnor Formation is absent on site at the Earl Pumping Station. There is expected to be hydraulic continuity between the upper and lower aquifers at the Earl Pumping Station site.

13.4.5 Initial drilling took place during 2009 in the vicinity of Earl Pumping Station. In 2012, a number of on-site boreholes were sunk on the Earl Pumping Station CSO site. The information on depths and thicknesses of geological layers has been compiled from all the available ground investigation holes drilled locally. The depths and thicknesses of the geological layers encountered are summarised in Vol 22 Table 13.4.1.

**Vol 22 Table 13.4.1 Groundwater – anticipated ground conditions/hydrogeology**

| Formation | Top elevation* (mATD) | Depth (m) | Thickness (m) | Hydrogeology |
|---|---|---|---|---|
| Superficial Deposits/Made Ground*** | 101.70 | 0.00 | 2.90 | Hydraulic continuity with upper aquifer** |
| River Terrace Deposits | 98.80 | 2.90 | 5.20 | Upper aquifer |
| Lambeth Group (Upnor Formation)**** | 93.60 | 8.10 | 1.90 | Lower aquifer |
| Thanet Sand Formation | 91.70 | 10.00 | 4.80 | |
| Seaford Chalk | 86.90 | 14.80 | 36.0 | |
| Lewes Nodular Chalk | 50.90 | 50.8 | Not proven | |

[ix] Secondary aquifer – either permeable strata capable of supporting local supplies or low permeability strata with localised features such as fissures (was previously referred to as a minor aquifer).

** Based on assumed ground level of 101.4mATD*
***It has been assumed that the made ground and alluvium are in hydraulic connectivity for the purposes of this assessment*
**** Alluvium has been found on site between the Made Ground and River Terrace Deposits.**** Lambeth Group (Upnor Formation) is absent on site ie River Terrace Deposits overlie the Thanet Sands*

### Groundwater level monitoring

13.4.6 Groundwater level monitoring has been undertaken at a number of boreholes across the assessment area (1km radius of the site). In addition, the EA has a regional network of monitoring boreholes, mainly within the lower aquifer, across London with records available dating back over 50 years.

13.4.7 Thames Tideway Tunnel project monitoring boreholes have yet to be completed on site at the Earl Pumping Station site (although ground investigation boreholes on site have provided groundwater quality information and an initial indication of water levels in March 2012). The main information on groundwater levels for this assessment has therefore been collected from the six ground investigation boreholes (PR1027, SR1028, SR1046 to SR1049 inclusive) located within the assessment area. These off site boreholes have response zones[x] in the River Terrace Deposits, Thanet Sands and the Chalk, and are monitoring groundwater levels in both the upper and lower aquifer. The locations are shown in Vol 22 Figure 13.4.3 (see separate volume of figures). Vol 22 Table 13.4.2 summarises the minimum, average and maximum water levels at the six ground investigation boreholes.

**Vol 22 Table 13.4.2 Groundwater – water level summary**

| Borehole ID | Formation | Average water level (mATD) | Minimum water level (mATD) | Maximum water level (mATD) |
|---|---|---|---|---|
| SR1048 | Chalk | 98.03 | 97.74 | 98.31 |
| PR1027 | Thanet Sands | 98.96 | 98.62 | 99.20 |
| | Chalk | 99.02 | 98.79 | 99.36 |
| SR1028 | River Terrace Deposits | 98.93 | 97.56 | 99.40 |
| | Chalk | 99.24 | 98.31 | 99.82 |
| SR1046 | Chalk | 98.78 | 98.60 | 98.99 |
| SR1047 | Chalk | 98.32 | 98.05 | 98.59 |
| SR1049 | Chalk | 96.72 | 96.53 | 96.88 |

13.4.8 The recorded water levels in the River Terrace Deposits at SR1028 suggest that the upper aquifer has the potential to be confined, by the

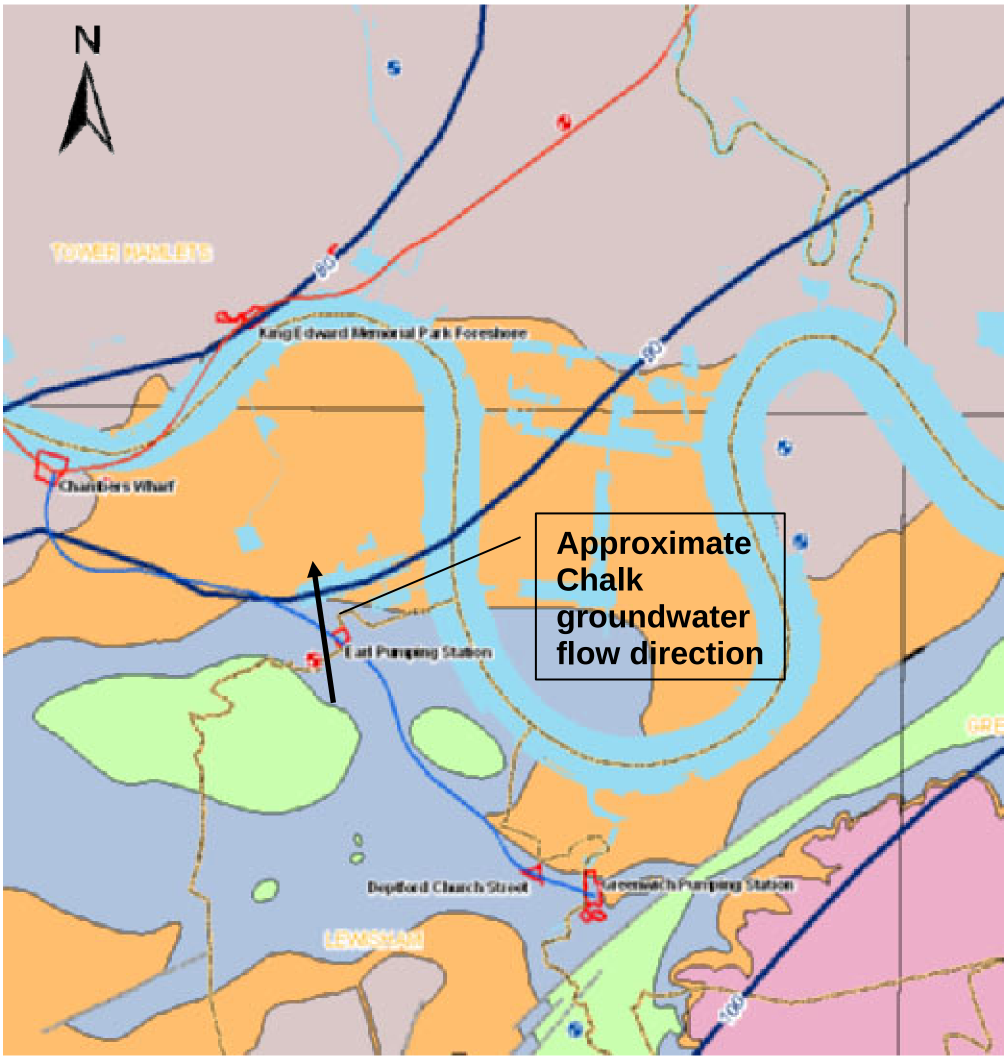
[x] Response zone – the section of a borehole that is open to the host strata (EA, 2006).

overlying Made Ground and Alluvium, which predominantly consists of clay and peat at this borehole. These confining or semi-confining conditions are not anticipated at the Earl Pumping Station site but this has yet to be confirmed by the groundwater level monitoring.

13.4.9 The recorded water levels in the River Terrace Deposits and the Seaford Chalk at SR1028 show very similar fluctuations, suggesting that these units are in hydraulic continuity at this location. The proximity of this monitoring borehole to the River Thames and the magnitude of fluctuation suggest that these fluctuations are tidal. The monitoring boreholes SR1046 to SR1049 inclusive also show tidal fluctuations but at a reduced magnitude to SR1028, due to the increased distance from the River Thames.

13.4.10 The recorded water levels in the Thanet Sand and the Lewes Nodular Chalk at PR1027 are consistently above the top of these formations implying hydraulic continuity with the overlying permeable formations at this location. The EA produces an annual regional groundwater level contour map (piezometry) of the Chalk, showing a snap-shot of groundwater flows in time (EA, 2011b) (see Vol 22 Plate 13.4.1). The January 2011 map indicates that the regional direction of groundwater flow (perpendicular to groundwater contours) at this point in time was northwest in the Chalk around the Earl Pumping Station site. The location of the closest EA groundwater level monitoring borehole, and its respective hydrograph, is shown in Vol 22 Figure 13.4.4 (see separate volume of figures).

**Vol 22 Plate 13.4.1 Groundwater – Chalk groundwater level contour map**




London Clay Formation | Lambeth Group | Thanet Sands Formation | Chalk

Chalk piezometry (EA, Jan 2011) | Shaft site working boundary | Main tunnel route | Connection tunnel

**Extract from Vol 22 Figure 13.4.2 (see separate volume of figures)*

13.4.11 The monitoring undertaken as part of the ground investigation undertaken in 2012 at the Earl Pumping Station site, indicates that the groundwater flow direction is towards either the southwest (in February 2012) or southeast (in March 2012) on site. Given that Chalk regional direction of flow is also towards the northwest, this could indicate that a limited hydraulic connection between the River Terrace Deposits and the Chalk, however more monitoring is required in the vicinity of the Earl Pumping Station site. In the meantime, an hydraulic connection between the upper and lower aquifer is assumed for the Earl Pumping Station site.

13.4.12 Further detail on water level monitoring is provided in Vol 22 Appendix K.3.

### Licensed abstractions

13.4.13 There are two licensed abstractions (28/39/42/0073 and 28/39/42/0048) from the Chalk within 1km of the Earl Pumping Station shaft; one of these lies to the north and one to the northwest. These are considered to be located down hydraulic gradient from the Earl Pumping Station site and as pumping from within the diaphragm wall at this site would be less than 200$m^3$/d, the hydraulic gradient would not be reversed. The use of both these licences is for industrial, commercial and public services, including for drinking, cooking and sanitary purposes in one case and for amenity purposes in the other case.

13.4.14 There are no licensed abstractions from the River Terrace Deposits or known unlicensed abstractions within 1km of the Earl Pumping Station site.

### Groundwater source protection zones

13.4.15 The nearest Source Protection Zone (SPZ) around all major public water supply abstractions sources and large licensed private abstractions in order to safeguard groundwater resources from potentially polluting activities. The nearest modelled SPZ for a Chalk source lies approximately 1.4km to the southeast. This is not in the direction of the expected groundwater flow beneath the site (upper and lower aquifers), which is towards the northwest.

### Environmental designations

13.4.16 There are no other designations relevant to groundwater in the vicinity of the site.

### Groundwater quality and land quality

13.4.17 The groundwater quality assessment data obtained from ground investigation boreholes SA6450, SR4118, SA6455A, SA6453A and SA6451 (located on site) and SR1048, SR1047, SR1049, SR1046, PR1027, SR1028, SR1045, SR1050, SR1042 and SR1040 (located within 1km of the Earl Pumping Station site and shown in Vol 22 Figure 13.4.1 in separate volume of figures), show exceedances of the UK drinking water standards or relevant Environmental Quality Standards (EQS) pertaining to both brackish conditions (in the upper and lower aquifers). The occurrence of brackish conditions here is to be expected due to the location of the site close by the tidal reaches of the River Thames Further details are included in Vol 22 Appendix K.7.

13.4.18 The data also shows exceedances with respect to heavy metals, pesticides, hydrocarbons and a range of organic substances in the River Terrace Deposits and the Thanet Sands. In particular the onsite ground investigation boreholes in the River Terrace Deposits (SA6455, SA6450 and SR4118) showed some high exceedances of anthracene, benzene, fluroanthene, naphthalene, phenol, polycyclic aromatic hydrocarbon (PAH) and xylene compounds. The Thanet Sands boreholes on site (SA6451 and SA6455) showed exceedances of anthracene, benzene, heavy metals, naphthalene, phenol, PAHs and xylene compounds. In general, the number of substances exceeding standards was fewer in the Thanet Sand than in the River Terrace Deposits.

13.4.19 The concentrations for a majority of these organic compounds are highest in the River Terrace Deposits at SA6450, and there is a reduction in concentration within the Thanet Sands at SA6453A and SA6451.Full details of all groundwater quality data available for the site is included in Vol 22 Appendix K.7.

13.4.20 The land quality data from the ground investigation boreholes used in the groundwater quality assessment shows exceedances of the human health screening values (EA, 2009)[6] (soil guideline values designed to be protective of human health) within the Thanet Sand at SA6453A and SA6451 (both of which are located on site) with respect to hydrocarbons and PAH's. Further detail is provided in the land quality assessment (see Vol 22 Appendix F).

### Groundwater flood risk

13.4.21 There are no reported incidences of groundwater flooding in the vicinity of the site, based on information from the London Borough (LB) of Southwark Strategic Flood Risk Assessment (SFRA) (Jacobs, 2008)[7] and the LB of Lewisham SFRA (Jacobs, 2008)[8].

## Groundwater receptors

13.4.22 Groundwater receptors which could be affected during construction or operation are summarised in Vol 22 Table 13.4.3 below. Both the upper and lower aquifers have been assessed as receptors as both would be penetrated by the CSO drop shaft at the Earl Pumping Station site. There is two abstraction sources from the Chalk within 1km radius of the site and which have also been assessed for the construction phase.

**Vol 22 Table 13.4.3 Groundwater – receptors**

| Receptor | Construction | Operation | Comment |
|---|---|---|---|
| Groundwater body – upper aquifer | ✓ | ✓ | Penetrated by CSO drop shaft, interception chamber and culvert |
| Groundwater body – lower aquifer | ✓ | ✓ | CSO drop shaft into Chalk |
| Licensed abstractions | ✓* | × | Two Chalk abstractions with 1km (28/39/42/0073 28/39/42/0048 (Licence no. 28/39/42/0048 – Canada Water has two abstraction points) |
| Unlicensed abstractions | × | × | None known |
| Planned | ✓ | × | One planned GSHP in lower aquifer at Surrey |

| Receptor | Construction | Operation | Comment |
|---|---|---|---|
| developments | | | Canal Triangle |

**Abstractions (licensed) would only be affected by construction phase, due to dewatering.*
*Symbols ✓ applies ✗ does not apply*

## Receptor sensitivity

13.4.23 The upper aquifer is classified by the EA as a secondary A aquifer and is allocated a medium value in terms of quantity in this assessment. The upper aquifer has brackish water quality as a result of its location. Therefore it is categorised as being of low value with regard to quality close to the tidal reaches of the River Thames.

13.4.24 The lower aquifer is a principal aquifer as classified by the EA, and hence is categorised as being of high value with regard to quantity. Given that the baseline groundwater quality data suggest brackish conditions and there is known contamination locally, the lower aquifer is categorised as being of low value with regard to quality for drinking water purposes.

13.4.25 The sensitivity of individual abstraction licences has been assessed depending on their use, for example, a higher value is given to sources used for drinking water than for industrial purposes, which in turn are given a higher value than for amenity purposes. Also larger public water supply abstractions are given a higher value than generally smaller domestic supplies.

13.4.26 A summary of the value and sensitivity of relevant receptors is given in Vol 22 Table 13.4.4.

**Vol 22 Table 13.4.4 Groundwater – construction receptors**

| Receptor | Value/sensitivity |
|---|---|
| **Groundwater quality** | |
| Upper Aquifer | Low value; brackish conditions and known contamination. |
| Lower Aquifer | Low value; brackish conditions and known contamination, limiting use for drinking water purposes. |
| **Groundwater quantity (resources)** | |
| Upper Aquifer | Medium value; secondary A aquifer. |
| Lower Aquifer | High value; principal aquifer. |
| Licensed Chalk abstraction 28/39/42/0073 | High value; industrial source and for drinking, cooking and sanitary purposes. |
| Licensed Chalk abstraction 28/39/42/0048 | Medium value; industrial source and for amenity purposes. |

### Construction base case

13.4.27 The construction base case in Site Year 1 is as per the current baseline and also includes any developments that are likely to be complete and partially or fully operational during construction at the Earl Pumping Station site, and which would have the potential to lead to a change to groundwater in the upper and lower aquifers.

13.4.28 The basements associated with other development identified in Vol 22 Table 13.3 1 could cause some disruption to groundwater flow in the upper aquifer. Any substantive changes from the baseline conditions prior to construction would be detected by monitoring of groundwater levels in the upper aquifer. Any potential SuDS schemes at Oxestalls Road or Surrey Canal Triangle are unlikely to impact on groundwater levels in the upper aquifer as the proposed developments are not located immediately up or down-gradient of the Earl Pumping Station site.

13.4.29 The base case in Site Year 1 of construction at the Thames Tideway Tunnel project site would include one planned abstraction for GSHP in the lower aquifer, at the Surrey Canal Triangle site, as identified in Vol 22 Table 13.3 1, as this is likely to be active at the time of construction.

### Operational base case

13.4.30 The operational base case is as per the construction base case. Therefore it can be concluded that there would be no change to the base case on Year 1 of operation in terms of groundwater flow in both the upper and lower aquifers.

## 13.5 Construction effects assessment

### Construction impacts

#### Dewatering of aquifers

13.5.1 Localised dewatering of the River Terrace Deposits may be required for the construction of the interception works. However any dewatering would take place inside the secant piles walls to a depth of between 11 and 20mbgl (see para 13.2.7) which would be constructed around the interception works. No licensed abstractions have been identified; therefore, the magnitude of this impact on the upper aquifer is assessed to be negligible.

13.5.2 For the construction of the Thames Tideway Tunnel project as a whole, groundwater levels would have to be lowered by dewatering to allow construction of main tunnel, CSO drop shafts, connection culverts and interception chambers. The impact of this project-wide dewatering is discussed in detail in Vol 3 Section 10. Impacts have been quantified by modelling (see Vol 3 Section 10 Appendix K.2) and the effects, where they are of relevance to the Earl Pumping Station site, are included in this assessment.

13.5.3 The design at the Earl Pumping Stations site uses diaphragm walls that hydraulically isolate the inside of the CSO drop shaft from the surrounding ground. The amount of dewatering which would be needed at the Earl

Pumping Station site is estimated at less than 200m$^3$/d and would be pumped from within the diaphragm walls ("internal dewatering"). Any drawdown within the shaft would be isolated from water levels outside the diaphragm wall and it is anticipated that these levels would only be lowered by a few centimetres (based on experience from the Lee Tunnel project (WJ Groundwater, 2012)[9].

13.5.4 Details of the groundwater modelling undertaken to inform the assessment of likely significant effects at the Earl Pumping Station are included in the project-wide assessment in Vol 3 Appendix K.2. The groundwater level monitoring (see the draft groundwater monitoring strategy Vol 2 Appendix K.1) reflects the pumping from local abstraction sources, one of these lies to the north and one to the northwest (see para. 13.4.13).

13.5.5 In addition to the limited dewatering at Earl Pumping Station drop shaft described above (see para. 13.5.2), there would also be drawdown (lowering of groundwater levels) of the lower aquifer as a result of dewatering concurrently at other Thames Tideway Tunnel sites.

13.5.6 The full details of the effects on licensees in the vicinity of Earl Pumping Station site are set out in the modelling report (see Vol 3 Section 10 Appendix K.2). For each licensee the impact of drawdown is assessed by comparing it to the maximum available drawdown (MAAD)[xi] at the licensee's borehole(s).

a. In the case of licence number 28/39/42/0073 (Harmsworth Quays Printing Ltd), modelling has predicted a maximum drawdown of 1.6m, this is less than the MAAD of 13m. The magnitude of impact is therefore assessed to be negligible.

b. In the case of licence number 28/39/42/0048 (LB of Southwark), there are two boreholes, A and B. Modelling has predicted a maximum drawdown of 2m at borehole A, this is less than the MAAD of 7m. The magnitude of impact at borehole A is assessed to benegligible.

c. In the case of licence number 28/39/42/0048 borehole B, modelling has predicted a maximum drawdown of 2m, this is less than the MAAD of 16m. The magnitude of impact at borehole B is assessed to be negligible at borehole B.

### Groundwater quality

13.5.7 The water quality baseline data from nearby ground investigation boreholes show exceedances in the River Terrace Deposits, Thanet Sands and in the Chalk pertaining to brackish conditions, which may restrict its use for drinking water supplies. These brackish conditions are to be anticipated in a location close to the tidal Thames and a hydraulic connection between surface water and groundwater which is known between Greenwich and Woolwich (see published information in Vol 3 Section 10).

[xi] Maximum available drawdown – is defined as the difference between the pumped water level and depth of the pump or difference between the pumped water level and the top of the Thanet Sand (which is designed to prevent oxidation and the mobilisation of natural pollutants); whichever is least of these two values is applied with this assessment.

13.5.8 The data also show exceedances of heavy metals, pesticides, hydrocarbons and a range of organic substances in the groundwater in the River Terrace Deposits and the Thanet Sands.

13.5.9 The CSO drop shaft construction may create a pathway for groundwater movement between the CSO drop shaft and the ground, where an effective seal is not in place. However, the diaphragm wall would seal out the upper aquifer and any water encountered would be pumped out and disposed of appropriately, following the measures identified within the *CoCP* (and detailed in Section 13.2), and subject to EA approval. The magnitude of the impact on the upper aquifer has been assessed to be negligible.

13.5.10 In addition, there is the potential for poor quality groundwater to migrate and to further degrade groundwater quality in the lower aquifer. The nearest licensed abstractions are located down gradient of the site within a kilometre. The Chalk is known to have low transmissivity locally (see para. 13.5.13); therefore, any risk to these abstraction sources is considered minimal. The magnitude of the impact on the lower aquifer is assessed to below.

13.5.11 The potential for movement of contamination at Earl Pumping Station by project-wide dewatering is discussed in Vol 3 Section 10. Given the high number of water quality exceedances identified in both the upper and lower aquifer (Vol 22 Appendix K.7), then a quantitative risk assessment to address concerns about the effects on the wider water environment would be required for this site and approval sought from the EA prior to works commencing.

13.5.12 Ground treatment and secant piles would limit the need for localised dewatering within the upper aquifer at the Earl Pumping Station site. There are no licensed abstraction sources within the upper aquifer located within 1km of the site. The magnitude of impact on the upper aquifer is assessed to be negligible.

13.5.13 Ground treatment by grouting is proposed at this site. The hydraulic properties information (see Vol 22 Appendix K.2) for the area indicates a low transmissivity value. The amount of treatment would depend on the depth of diaphragm wall and the ground conditions encountered. There is the potential for grout contaminated groundwater (characterised by excess turbidity) to migrate and impact on groundwater quality in the lower aquifer. However grout setting generally occurs on a timescale of a few minutes and therefore in most circumstances the impact is likely to be localised the magnitude of the impact on the lower aquifer is assessed to be negligible. No ground treatment is anticipated to be required within the upper aquifer. The magnitude of the impact on the upper aquifer is assessed to be negligible.

13.5.14 The EA aims to manage groundwater abstractions to keep groundwater levels above the top of the Thanet Sands. The lowering of water levels below the top of the Thanet Sands may lead to deterioration in water quality within the lower aquifer. The project-wide dewatering within the lower aquifer would draw water levels down at the Earl Pumping Station site by an estimated 1m and this level of drawdown is not anticipated to result in any substantial changes in groundwater quality. The magnitude of this project-wide impact on groundwater quality has been anticipated to be negligible and has been dealt with further in Vol 3 Section 10.

### Physical obstruction

13.5.15 The presence of the diaphragm walls used to build the CSO drop shaft and the secant pile walls around the interception chamber and connection culvert may disrupt groundwater flow and alter groundwater levels within the upper aquifer.

13.5.16 The methodology for assessing the impact of all below ground activities upon the groundwater levels in the upper aquifer is described in Vol 2 Appendix K.2. It is estimated that the groundwater level would rise during the construction phase at the Earl Pumping Station by approximately 0.15m, based on an estimated hydraulic gradient of 0.004.

13.5.17 Groundwater levels in the upper aquifer can reach 99.4mATD; this is approximately 2m below the existing ground surface at Earl Pumping Station of 101.4mATD (see Vol 22 Table 13.4.1). Therefore the small predicted rise in water levels (0.2m) on the southeast (upstream) side of the Earl Pumping Station site, the change in groundwater levels as a result of physical obstruction would result in a low magnitude of impact on the upper aquifer.

13.5.18 The presence of the CSO drop shaft in the lower aquifer may form a physical obstruction to local groundwater flow around the shaft. The impact of this change is reduced because of the distance to the nearest abstraction point. In addition, given the direction of groundwater flow towards the northwest, this abstraction point is not directly down hydraulic gradient. The impact on this source is assessed as being negligible.

## Construction effects

13.5.19 By combining the impacts identified above with the receptor value as shown in Vol 22 Table 13.4.4, the significance of the effects can be derived using the generic significance matrix (Vol 2 Section 2). The results are described in the following sections.

### Dewatering of aquifers

13.5.20 The secant pile walls constructed around the interception works would limit the effects on the upper aquifer. This negligible impact on the upper aquifer, a medium value receptor with regards groundwater quantity, would lead to a **negligible** effect.

13.5.21 Overall, the effects from dewatering of the lower aquifer are expected to be between minor adverse and negligible depending on the licence use as follows:

a. Lower aquifer is classified as a high value receptor in terms of groundwater resources. A negligible impact on this high value receptor would result in a **minor adverse** effect.

b. Licence number 28/39/42/0073 is licensed for use for industrial, commercial and public services including drinking, cooking and sanitary purposes amongst other things, meaning that the source is classified as of high value. A negligible impact on this high value source would lead to a **minor adverse** effect.

c. Licence number 28/39/42/0048 (borehole A) is licensed for use for industrial, commercial and public services including amenity purposes and is classified as of medium value. A negligible impact on this medium value receptor would lead to a **negligible** effect.

d. Licence number 28/39/42/0048 (borehole B) is also used for amenity purposes and is classified as of medium value. A negligible impact on this medium value receptor would lead to a **negligible** effect at this source.

### Groundwater quality

13.5.22 A negligible impact on groundwater quality in the upper aquifer has been identified as a result of the use of secant piles and minimal dewatering at the site. No grouting is proposed within the River Terrace Deposits. A negligible impact on a low value receptor (the upper aquifer with regard to groundwater quality) would lead to a **negligible** effect.

13.5.23 Medium impacts on groundwater quality in the lower aquifer have been identified as a result of the exceedances polycyclic aromatic hydrocarbon (PAH) and phenol compounds in the Thanet Sands. Although there is known groundwater and soil contamination at the site, movement is expected to be minimal as a result of internal dewatering and the small amounts of dewatering required at this site. A low impact on a low value receptor (the lower aquifer with regard to groundwater quality) would lead to a **negligible** effect.

13.5.24 A negligible impact on groundwater quality in the lower aquifer has been identified as a result of grouting in low transmissivity Chalk. A negligible impact on a low value receptor (the lower aquifer with regard to groundwater quality) would lead to a **negligible** effect.

13.5.25 Project-wide dewatering would not lower groundwater levels below the top of the Thanet Sands at this location. A negligible impact on the lower aquifer, a low value receptor for groundwater quality, would lead to a **negligible** effect.

13.5.26 The potential for movement of contamination at Earl Pumping Station by project-wide dewatering is discussed in Vol 3 Section 10.

### Physical obstruction

13.5.27 The physical impact of all below ground activities upon the local groundwater levels in the upper aquifer is considered low. This low impact on a medium value receptor, the upper aquifer with regards to groundwater quantity, would lead to a **minor adverse** effect.

13.5.28 The physical impact of the CSO drop shaft upon the lower aquifer can be considered negligible given the extent and thickness of the lower aquifer and the distance to the nearest licensed abstraction source. A negligible impact on a high value receptor, the lower aquifer with regards to groundwater quantity, would lead to a **minor adverse** effect.

# 13.6 Operational effects assessment

## Operational impacts

### Physical obstruction

13.6.1 The presence of the operational sub-surface structures in the upper aquifer may disrupt groundwater flow and alter groundwater levels.

13.6.2 The methodology for assessing the impact upon the groundwater levels in the upper aquifer is described in Vol 2 Appendix K.3. It is estimated that the groundwater level rise during the operational phase at Earl Pumping Station would be less than 0.1m, based on a hydraulic gradient of 0.004. This number is less than the impact predicted during the construction phase. This is because the obstruction effects of the operational site, principally the shaft, would be less than they would for the construction site, with the associated secant pile walls around interception chamber and connection culverts.

13.6.3 Groundwater levels in the upper aquifer can reach 99.4mATD; this is approximately 2m below the existing ground surface at Earl Pumping Station. Given the small predicted rise in water levels (<0.1m) on the southeast (upstream) side of the structure, the magnitude of impact would be negligible.

13.6.4 The CSO drop shaft would extend down up to 40m into the lower aquifer, a considerable section of the lower aquifer. However, with the shaft at approximately 22m (external diameter) and the distance to the nearest abstraction to the north of the site and within a kilometre, the overall obstruction to flows within the lower aquifer are likely to be limited. The impact on this source is assessed as being negligible.

### Seepage into CSO drop shaft

13.6.5 An estimate of the theoretical seepage volumes into the shaft at Earl Pumping Station is included in Vol 2 Appendix K.3. The estimated loss of water resources from the upper aquifer from seepage is 101$m^3$/annum (see Vol 2 Appendix K.3 Table L.4) and is assessed as negligible for the upper aquifer.

13.6.6 The estimated loss of water resources from the lower aquifer is 806$m^3$/annum which is considered to be a negligible impact.

### Seepage from CSO drop shaft

13.6.7 An estimate of the theoretical seepage volumes from the drop shaft at Earl Pumping Station is included in Vol 2 Appendix K.3 The shaft would be full for only approximately 3% of the year or 11 days per year (see Vol 3 Section 10). The estimated volume of seepage from the drop shaft into the upper aquifer is 3$m^3$/annum (see Vol 2 Appendix K.3). In addition, higher heads outside the drop shaft means that any risk of seepage from the drop shaft into the upper aquifer would be further reduced. The magnitude of impact has been assessed as negligible for the upper aquifer.

13.6.8 The estimated volume of seepage from the drop shaft into the lower aquifer is 24m$^3$/annum (see Vol 2 Appendix K.3). The magnitude of impact has been assessed as negligible for the lower aquifer.

13.6.9 No other operational impacts are envisaged.

### Operational effects

13.6.10 By combining the receptor value (see Vol 22 Table 13.4.4) with the impacts identified above, the significance of the effects can be derived using the generic significance matrix (Vol 2 Section 2). The results are described in the following sections.

#### Physical obstruction

13.6.11 The anticipated rise in upper aquifer water levels on the southeast side of the CSO drop shaft is less than 0.1m, and is considered to be a negligible impact. A negligible impact on a medium value receptor (upper aquifer) for groundwater quantity would lead to a **negligible** effect.

13.6.12 The negligible impact of physical obstruction, on a high value receptor (lower aquifer), would lead to a **minor adverse** effect on groundwater quantity in the lower aquifer.

#### Seepage into CSO drop shaft

13.6.13 Seepage into the CSO drop shaft has been determined as a negligible impact, which on a medium value aquifer (the upper aquifer) with regards to groundwater quantity would lead to a **negligible** effect.

13.6.14 The same impact on the lower aquifer, which has high value with regards to groundwater quantity would lead to a **minor adverse** effect.

#### Seepage from CSO drop shaft

13.6.15 There would be a negligible impact on the upper aquifer as a result of seepage from the CSO drop shaft. The low value of the upper aquifer as a receptor with regards to groundwater quality would lead to a **negligible** effect.

13.6.16 In the case of the lower aquifer, seepage from the CSO drop shaft would also result in a negligible impact. The low value of the lower aquifer as a receptor with regards to groundwater quality would lead to a **negligible** effect.

## 13.7 Cumulative effects assessment

### Construction effects

13.7.1 Six developments have been identified in Vol 22 Table 13.3 1 which could give rise to cumulative effects relevant to groundwater in the upper aquifer through the inclusion of basements and SuDS. It is considered that although there may be an impact on groundwater levels in the upper aquifer due to these developments, the impacts are not expected to be significant and any substantive changes to the baseline conditions prior to construction would be detected by monitoring of groundwater levels in the upper aquifer. No significant cumulative effects on the upper aquifer are expected as a majority of the developments are located a long distance away. This is because a majority of the developments are located up hydraulic gradient or are at large distances from the CSO site.

13.7.2 One development has been identified in Vol 22 Table 13.3 1 which could potentially give rise to cumulative effects relevant to groundwater resource in the lower aquifer through the inclusion of a GSHP. However, the GSHP has already been considered and added to the base case in the construction assessment as the development is likely to be partially complete and operational during construction of the Thames Tideway Tunnel project. No significant cumulative effects on the lower aquifer are expected because of the location of the development up hydraulic gradient and at a distance of 900m from the CSO site.

### Operational effects

13.7.3 One development has been identified in Vol 22 Table 13.3.2 which could give rise to cumulative effects relevant to groundwater in the upper aquifer through the inclusion of a basement and SuDS. It is considered that although there may be some impact on groundwater levels in the upper aquifer due to this development, the impacts are not expected to be significant and any changes to the baseline conditions prior to construction would be detected by monitoring of groundwater levels in the upper aquifer. No significant cumulative effects on the upper aquifer are expected.

13.7.4 One development was identified in Vol 22 Table 13.3.2 which could potentially give rise to cumulative effects during construction relevant to groundwater in the lower aquifer through the inclusion of a GSHP. As the development will already be partially complete and operational at the start of Thames Tideway Tunnel project, the GSHP was not added for the operational base case as there would be no impact from dewatering undertaken as part of the construction phase.

## 13.8 Mitigation

13.8.1 There are few impacts from the construction phase and those which have been identified would have negligible or minor adverse effects. No mitigation is therefore required.

13.8.2 Similarly no significant effects are identified in the operational phase and no mitigation is required.

13.8.3 The potential for movement of contamination at Earl Pumping Station by project-wide dewatering is discussed in Vol 3 Section 10.

## 13.9 Residual effects assessment

### Construction effects

13.9.1 As no mitigation measures are required, the residual construction effects remain as described in Section 13.5. All residual effects are presented in Section 13.10.

### Operational effects

13.9.2 As no mitigation measures are required, the residual operational effects remain as described in Section 13.6. All residual effects are presented in Section 13.10.

## 13.10 Assessment summary

**Vol 22 Table 13.10.1 Groundwater – construction assessment summary**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Upper aquifer (licensed abstractions) | Lowering of groundwater levels in upper aquifer. | Negligible | None | Negligible |
| Lower aquifer (licensed Chalk abstractions) | Lowering of groundwater levels in the Chalk resulting from dewatering. | Lower aquifer – Minor adverse | None | Minor adverse |
| | Lowering of groundwater levels in the Chalk resulting from dewatering. | 28/39/42/0073 – Minor adverse | None | Minor adverse |
| | Lowering of groundwater levels in the Chalk resulting from dewatering. | 28/39/42/0048 (Borehole A) – Negligible | None | Negligible |
| | Lowering of groundwater levels in the Chalk resulting from dewatering. | 28/39/42/0048 (Borehole B) – Negligible | None | Negligible |
| Upper aquifer (groundwater quality) | Deterioration in groundwater quality caused by creation of a pathway. | Negligible | None | Negligible |
| Lower aquifer (groundwater quality) | Deterioration from drawing down water levels. | Negligible | None | Negligible |
| | Deterioration in water quality in the Chalk from grouting. | Negligible | None | Negligible |
| | Deterioration in groundwater quality caused by creation of a pathway. | Negligible | None | Negligible |
| Upper aquifer | Change in groundwater storage and flood risk as a result of physical | Minor adverse | None | Minor adverse |

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| | obstruction in upper aquifer. | | | |
| Lower aquifer | Change in groundwater storage as a result of physical obstruction in lower aquifer. | Minor adverse | None | Minor adverse |

**Vol 22 Table 13.10.2 Groundwater – operational assessment summary**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Upper aquifer | Change in groundwater levels as a result of physical obstruction. | Negligible | None | Negligible |
| Lower aquifer | Change in groundwater levels as a result of physical obstruction. | Minor adverse | None | Minor adverse |
| Upper aquifer | Seepage into shaft affecting groundwater resources. | Negligible | None | Negligible |
| Lower aquifer | Seepage into shaft affecting groundwater resources. | Minor adverse | None | Minor adverse |
| Upper aquifer | Deterioration in water quality in the upper aquifer from seepage out of shaft. | Negligible | None | Negligible |
| Lower aquifer | Deterioration in water quality in the lower aquifer from seepage out of shaft. | Negligible | None | Negligible |

# References

[1] Defra. *National Policy Statement for Waste Water* (2012)

[2] Environment Agency. *Introducing pollution prevention: PPG 1 – EA Consultation* (2011a).

[3] Environment Agency and ESI. *London Basin Aquifer Conceptual Model*. *ESI Report Reference 60121R1* (June 2010).

[4] Environment Agency. *Groundwater levels contours in Chalk*. Received from Environment Agency, (June 2011b).

[5] British Geological Survey. British geology onshore digital maps 1:50 000 scale. Received from Thames Tunnel, February 2009.

[6] Environment Agency. Soil Guideline Value Reports (2009). Available at: http://www.environment-agency.gov.uk/research/planning/64015.aspx.

[7] Jacobs. *London Borough of Southwark Strategic Flood Risk Assessment (SFRA)*. *Final Report* (February 2008).

[8] Jacobs. *London Borough of Lewisham SFRA. Final Report* (July 2008).

[9] WJ Groundwater. *Lee Tunnel Abbey Mills Shaft F Pump Out Test Factual Report. 432/1770* (March 2012).

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**Thames Tideway Tunnel**
Thames Water Utilities Limited

Thames Water

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 14: Water resources - surface water

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

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 14: Water resources – surface water

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# 14 Water resources – surface water

## 14.1 Introduction

14.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on surface water at the Earl Pumping Station site. The assessment of surface water presented in this section has considered the requirements of the National Policy Statement for Waste Water, 2012 (NPS)[1]. The physical characteristics of the surface water environment including surface water resources and quality are presented and the anticipated effects (including cumulative effects) on these resources addressed in the assessment that follows. Further details on how the NPS requirements relevant to surface water resources have been met can be found in Vol 2 Section 14.3.

14.1.2 The proposed development has the potential to affect surface water resources (ie, surface waterbodies including the tidal reaches of the River Thames [tidal Thames]) due to:

a. construction activities

b. operation of the main tunnel.

14.1.3 The assessment of construction and operational effects on surface water includes the following:

a. identification of existing surface water resources baseline conditions

b. determining base case conditions against which the proposed development has been assessed

c. assessment of significant effects of the proposed development during construction and operation

d. identification of mitigation measures and the residual effects both during construction and operation.

14.1.4 The assessment of surface water partially overlaps with that for groundwater, land quality, aquatic ecology and flood risk. Effects on groundwater resources are assessed separately in Section 13 –of this volume. Land quality is addressed in Section 8 of this volume. Effects on aquatic ecology are assessed in Section 5 of this volume. A Flood Risk Assessment (FRA), which assesses the effects of the proposed development on surface water run-off and considers the use of Sustainable Drainage Systems (SuDS), has been carried out separately and is included in Section 15 of this volume.

14.1.5 This assessment covers the effects of the proposed development in relation to the interception of Earl Pumping Station combined sewer overflow (CSO). It is however important to recognise that whilst the reduction in spills from the Earl Pumping Station CSO would be important to water quality in the immediate area of the CSO, the overall water quality benefits in any part of the tidal Thames would accrue as a result of the project as a whole, rather than a single part of it. The catchment-wide effects on the tidal Thames, particularly the water quality improvements anticipated from Thames Tideway Tunnel project are assessed separately and are presented in Volume 3 Project-wide effects assessment Section 14.

14.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station Figures).

## 14.2 Proposed development relevant to surface water resources

14.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to surface water are set out below.

### Construction

14.2.2 The site is located within Thames Water's Earl Pumping Station. The site lies behind flood defences approximately 600m west from the tidal Thames and 200m southwest of the Surrey Commercial Docks. There is therefore no direct pathway to the tidal Thames, but it is considered that an indirect pathway to the river is present via the surface water and combined drainage system.

14.2.3 Based on the geology at the site, the construction of the shaft and associated infrastructure would require dewatering and/or ground treatment. However, internal dewatering of the shaft and associated works is proposed to limit the volume of dewatering required. Disposal of dewatering effluent can have an impact on surface water resources. See Section 13 of this volume for further details on the dewatering requirements.

### Code of Construction Practice

14.2.4 There is an indirect pathway for pollutants to be discharged to the tidal Thames via surface water drains. The *Code of Construction Practice* (CoCP)[i] Part A (Section 8) includes a number of measures to minimise the potential for impacts to surface waters including impacts such as discharge of pollutants via surface water drains and these are summarised below.

14.2.5 Appropriate drainage, sediment and pollution control measures are included in the *CoCP* (Section 8). These are in accordance with the relevant Pollution Prevention Guidelines (PPGs) issued by the Environment Agency (EA) and other Construction Industry Research and Information Association (CIRIA) documents.

[i] The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

14.2.6 All site drainage would be drained and discharged to mains foul or combined sewers. Where this is not practicable, the site would be drained such that accumulating surface water would be directed to holding or settling tanks, separators and other measures prior to discharge to the surface water drains. Foul drainage from the site welfare facilities would be connected to the mains foul or combined sewer.

14.2.7 Suitable spill kits would be provided and positioned in vulnerable areas and staff would be trained in their use and a record would be kept of all pollution incidents or near-misses, to ensure appropriate action is taken and lessons are learned from incidents. Regular ‘toolbox talks’ would be held to raise staff awareness of pollution prevention and share lessons learned from any recorded incidents. There would be written procedures in place for dealing with spillages and pollution (*The Pollution Incident Control Plan* or *PICP*).

14.2.8 There are two site specific measures incorporated in the *CoCP* Part B (Section 8) relevant to the surface water assessment. Pollution control measures are to be defined by the contractor and accepted by the relevant authorities prior to dewatering of potentially heavily contaminated materials. In addition, all temporary hardstanding (as far as reasonably practicable) on non-foreshore sites, is to incorporate permeable surfacing.

### Operation

14.2.9 The operation of the main tunnel would enable the interception of combined sewage generated during storms which would otherwise discharge to the tidal Thames from the Earl Pumping Station CSO. There would therefore be a reduction in the frequency, duration and volume of spills from this CSO.

## 14.3 Assessment methodology

14.3.1 The methodology used for the assessment of effects on surface water and their significance differs from the standard Website Transport Analysis Guidance (WebTAG) (DFT, 2003)[2] environmental impact assessment (EIA) methodology for water resources, in that the requirements of the Water Framework Directive (WFD) have also been taken into account. In the absence of an EIA specific assessment methodology for WFD compliance, an assessment methodology has been derived specifically for the Thames Tideway Tunnel project to assess significance of effects. The methodology also takes into consideration the requirements of the Urban Waste Water Treatment Directive (UWWTD)[3] and is outlined in Volume 2 Environmental assessment methodology Section 14. A WFD assessment for the project as a whole is presented in Vol 3 Section 14.

### Engagement

14.3.2 Vol 2 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Vol 2 Section 14 of this volume summarises the engagement that has been undertaken for the surface water assessment and the consultation responses relevant to surface water.

14.3.3 There are no site-specific engagement comments relevant to the surface water assessment at Earl Pumping Station.

## Baseline

14.3.4 The baseline methodology follows the methodology described in Vol 2 Section 14. There are no site specific variations for identifying baseline conditions for this site.

## Construction

14.3.5 The assessment methodology for the construction phase follows that described in Vol 2 Section 14. There are no site-specific variations for undertaking the construction assessment of this site.

14.3.6 The assessment year for construction effects is Site Year 1 (2017) when construction would commence. No modelled water quality data are available for this year. The water quality conditions for the base case have therefore been derived from available modelled simulation data which uses population projections for 2021. This assumption is considered reasonable as substantial changes in water quality are considered unlikely between 2017 and 2021.

14.3.7 The Lee Tunnel and the sewage works upgrades at Mogden, Beckton, Crossness, Long Reach and Riverside sewage treatment works (STWs) would be operational by the time construction of the Thames Tideway Tunnel project commences, as described in Vol 2 Section 14. Significant improvements in the water quality in the tidal Thames are anticipated as a result of these projects. Both the construction base case and the operational base case would be the water quality in the tidal Thames with the Lee Tunnel and sewage works upgrades in place.

14.3.8 The construction base case has considered developments that are scheduled to be complete and in operation by Site Year 1 (see Vol 22 Appendix N). These developments would not result in additional surface water receptors (ie, waterbodies) and are considered unlikely to result in changes in water quality as they are remote from the tidal Thames. The base case would therefore not change from that outlined above

14.3.1 The assessment area for the assessment of effects of construction activities at Earl Pumping Station site would be limited to one section of the river, namely the Thames Middle waterbody listed below in Vol 22 Table 14.4.1

14.3.2 Section 14.5 details the likely significant effects arising from the construction at the Earl Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on surface water within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

## Operation

14.3.3 The assessment methodology for the operation phase follows that described in Vol 2 Section 14. There are no site specific variations for undertaking the operational assessment of this site.

14.3.4 The assessment year for operation effects is Year 1 of operation. As with the construction assessment, the operational assessment also relies on modelled water quality data which uses population projections for 2021. In addition, the influence of climate change on the proposed development has been assessed in 2080.

14.3.5 As noted above, the operational base case would be the water quality in the tidal Thames with the Lee Tunnel and sewage works upgrades in place. The operational base case has considered the developments that are scheduled to be complete and in operation by Site Year 1 of operation (see Vol 22 Appendix N). These developments would not result in additional surface water receptors and are considered unlikely to result in changes in water quality as they are remote from the tidal Thames. The base case would therefore not change from that identified above.

14.3.6 Section 14.6 details the likely significant effects arising from the operation at the Earl Pumping Station site.

### Assumptions and limitations

14.3.7 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 14. Based on the geology at the site, it is assumed that the construction of the shaft and associated infrastructure would require dewatering and/or ground treatment. However, internal dewatering of the shaft and associated works is proposed to limit the volume of dewatering required. There are no other assumptions and limitations specific to the assessment of this site.

## 14.4 Baseline conditions

14.4.1 The following section sets out the baseline conditions for surface water within and around the site. Future baseline conditions (base case) are also described.

### Current baseline

#### Water quality

14.4.2 A list of all surface water receptors and their WFD status given in the River Basin Management Plan (RBMP) (EA, 2009)[4], which are either adjacent to the site or downstream of the site and therefore have the potential to be affected by the proposed development[ii], is included in Vol 22 Table 14.4.1 below.

14.4.3 The overall classification of status or potential under the WFD is a detailed process, which includes an assessment of water quality, physico-chemical, and hydromorphological elements. Reference should be made to the United Kingdom Technical Advisory Group (UKTAG)[5] guidance, as given in the RBMP (EA, 2009)[6].

[ii] The EA has provided advice on CSO excursion areas, which states that CSOs below Tower Bridge will only impact the Thames Middle waterbody and those upriver of Tower Bridge will impact both the Thames Upper and Thames Middle waterbodies.

**Vol 22 Table 14.4.1 Surface water – receptors**

| Waterbody name/ID | Hydro-morpho-logical status | Current ecological quality | Current chemical quality | 2015 Predicted ecological quality | 2015 Predicted chemical quality | 2027 target status |
|---|---|---|---|---|---|---|
| Thames Middle GB530603911402 | Heavily modified | Moderate potential | Fail | Moderate potential | Fail | Good |
| Surrey Commercial Docks | Not assessed under the WFD | | | | | |

14.4.4 The River Thames and its Tidal Tributaries are designated as a Site of Importance for Nature Conservation (Grade III of Metropolitan importance) The Thames Middle waterbody stretches from Battersea Bridge to Mucking Flats. This waterbody is considered to be a high value waterbody as although the current and predicted status in 2015 (target date from RBMP (EA, 2009)[7] is moderate potential, a status objective of good by 2027 has been set. In addition, the tidal Thames is a valuable resource, habitat and source of amenity, recreation, and transport throughout London.

14.4.5 The Surrey Commercial Docks are not assessed under the WFD and they are separated from the Thames Middle Waterbody by a series of lock gates. The main value of the Docks is thought to be amenity value and they are therefore considered to be a receptor of low value.

14.4.6 Sediment levels within the tidal Thames are estimated to currently reach a peak of 4,000kg/s in the lower tidal Thames estuary, or more than 40,000t of sediment a day during spring tides (HR Wallingford, 2006)[8].

14.4.7 There are no licensed surface water abstractions within 1km of the Earl Pumping Station site.

14.4.8 The Earl Pumping Station CSO lies between the EA's spot sample sites at London Bridge and Greenwich, approximately 1km upstream of Greenwich and approximately 6km downstream of London Bridge, as shown on Vol 22 Figure 4.4.1 (see separate volume of figures). 2011 summary data from these monitoring points, which give 90 percentile values for Nitrogen (concentration that is exceeded 10% of the time) and 10% percentile values for dissolved oxygen (DO) (concentration exceeded 90% of the time), is presented below in Vol 22 Table 14.4.2.

**Vol 22 Table 14.4.2 Surface water – EA spot samples**

| EA spot sample site | DO (mg/l) as 10%ile | Ammonium (mg/l) (90%) |
|---|---|---|
| London Bridge | 4.81 | 10.92 |
| Greenwich | 3.59 | 10.22 |

14.4.9 Classification of DO standards for transitional waters under the WFD is dependent on the salinity levels. The above 10 percentile values would place the Thames Middle waterbody within the good or moderate potential range, dependent on the associated salinity values.

14.4.10 The discharge from the Earl Pumping Station CSO has the effect of depleting DO in the tidal Thames as a result of the biological breakdown of organic matter in the discharges. This causes both a localised effect at the Earl Pumping Station CSO and a more widespread effect along the tidal Thames of rapidly dropping DO levels. Vol 3 details half-tide plots displaying the changes in DO along the tidal Thames.

14.4.11 The site has been subject to a number of potentially significant contaminative historical land-uses such as tar, asphalt and naphtha works as well as the existing use as a sewage pumping station. The surrounding area immediately to the south, east and west has previously supported potentially highly contaminating activities including tar works, whiting works and timber yards.

14.4.12 These have been recorded by intrusive ground investigations to have impacted the soils and upper and lower aquifer adjacent to the site. Preliminary information suggests that the underlying River Terrace Deposits and Thanet Sand Formation have been impacted with hydrocarbons. Groundwater in the upper aquifer is also impacted by free phase hydrocarbons. An assessment of potential on-site contamination is provided within Section 8 of this volume.

### Current CSO operation

14.4.13 The current operation of the Earl Pumping Station CSO has been characterised using the catchment model of the sewer system (see Vol 3 Section 14 for further details of catchment modelling) and the annual average duration, frequency and volume of spill have been defined as follows:

a. the CSO spills on average 26 times in the Typical Year[iii]

b. the CSO spills for a total duration of 184 hours in the Typical Year

c. the spill volume from the CSO is approximately 539,000m$^3$ in the Typical Year, representing 1.3% of the total volume discharged to the tidal Thames in the Typical Year from all CSOs.

[iii] Typical Year: single year which is most representative of an observed typical year of rainfall with the dataset. The 1979-1980 ‘water year’ defined as the 12 month period ending on the 30th September 1980

14.4.14 Using the same catchment model of the sewer system, the annual polluting loading of biochemical oxygen demand (BOD), ammonia and total Kjeldahl nitrogen (TKN) (the sum of organic nitrogen, ammonia ($NH_3$), and ammonium ($NH_4^+$)) of spill from the Earl Pumping Station CSO has been defined as follows:

a. the CSO discharges 49,000kg of BOD in the Typical Year

b. the CSO discharges 1,100kg of ammonia in the Typical Year

c. the CSO discharges 6,000kg of TKN in the Typical Year.

14.4.15 Each discharge increases the risk of exposure to pathogens for river users who come into contact with the water. An assessment of health impacts upon recreational users of the River Thames was conducted and reported by the Health Protection Agency in 2007 (Lane,C, Surman-Lee, S, Sellwodd, J and Lee, JV, 2007)[9]. The study concluded that risk of infection can remain for two to four days following a spill as the water containing the sewage moves back and forward with the tide[iv]. The same study also noted that analysis of the illness events reported against discharges on the tidal Thames shows that 77% of cases related to rowing activities undertaken within three days of a CSO discharge.

14.4.16 Assuming the average 26 spills per annum occur from the Earl Pumping Station CSO on separate days, there could be up to a maximum of 104 days per year where recreational users are at risk of exposure to pathogens in the vicinity of the outfall as a result of the Earl Pumping Station CSO spills alone (Lane et al., 2007)[10].

14.4.17 The operation of Earl Pumping Station CSO results in the discharge of sewage litter along with the discharge of effluent. It was estimated by the *Thames Tunnel Strategic Study* (Thames Water, 2005)[11] (TTSS) that overflows from all the CSOs along the tidal Thames introduce approximately 10,000t of sewage derived solid material to the tidal Thames annually. Catchment modelling of the current CSO operation has defined the average volume of discharge from Earl Pumping Station CSO and assuming litter tonnages are proportional to discharge volumes, this would indicate that approximately 135t of sewage derived litter is discharged from the Earl Pumping Station CSO in the Typical Year. An assessment of amenity effects of the sewage litter is given in Vol 3 Section 10 Socio-economics.

## Construction base case

14.4.18 As explained in Section 14.3, both the construction base case and the operational base case would be the water quality in the tidal Thames with the Lee Tunnel and sewage works upgrades in place (further details are provided below under operational base case).

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[iv] The EA has provided advice on CSO excursion areas[iv], which states that CSOs below Tower Bridge will only impact the Thames Middle waterbody and those upriver of Tower Bridge will impact both the Thames Upper and Thames Middle waterbodies.

14.4.19 The base case in Site Year 1 of construction taking into account the schemes described in Section 14.3 would not change since no new sensitive receptors would be introduced.

### Operational base case

14.4.20 As noted above, the operation base case would be the same as the construction base case and would include water quality improvement achieved by the Lee Tunnel and the sewage works upgrades

14.4.21 The base case in Year 1 of operation taking into account the schemes described in Section 14.3 would not change since no new sensitive receptors would be introduced.

14.4.22 Catchment modelling results of the base case have demonstrated that by Year 1 of operation (assessed using 2021 modelled assumptions), the volume of spills from the Earl Pumping Station CSO would have increased (as a result of increased population) beyond the current baseline as follows:

a. the CSO would spill 30 times in the Typical Year (4 more than the current baseline)

b. the CSO would spill for a total duration of 207 hours in the Typical Year (23 hours more than the current baseline)

c. the spill volume from the CSO would be approximately 594,000m$^3$ in the Typical Year (55,000m$^3$ more than the current baseline).

14.4.23 The same catchment modelling has demonstrated that by the operational assessment year the annual polluting loading of BOD, ammonia and TKN would have increased (as a result of increased population) beyond the current baseline as follows:

a. the CSO would discharge 60,500kg of BOD in the Typical Year (11,500kg more than the current baseline)

b. the CSO would discharge 1,600kg of ammonia in the Typical Year (500kg more than the current baseline)

c. the CSO would discharge 7,900kg of TKN in the Typical Year (1,800kg more than the current baseline).

14.4.24 Following on from the interpretation of the current baseline as per para. 14.4.17 the number of risk days for river users being exposed to pathogens during the operational base case year (taking into account to be 2021 modelled assumptions) would be a maximum of 120 days in the Typical Year as a result of spills from the Earl Pumping Station CSO alone.

14.4.25 Similarly, the tonnage of sewage derived litter discharged from the Earl Pumping Station CSO can be expected to increase by approximately 9% from approximately 135t to approximately 150t in the Typical Year.

## 14.5 Construction effects assessment

14.5.1 This section presents the construction impacts that could occur at the site and identifies where no further assessments of effects is required (eg, where the impact pathway has been removed). The second part of the section then identifies any effects that may occur and the likely significance of these effects.

### Construction impacts

#### Surface water drainage

14.5.2 There is an indirect pathway to the river via surface water drains for contaminated runoff, high suspended solids and other pollution from the site. However, appropriate site drainage would be used to control pollutants in the general site runoff, preventing the discharge of pollutants via combined or surface water drains as part of the surface water discharge from the construction site (see *CoCP* Part A Section 8). This would enable the pollution pathway to be removed and therefore there is considered to be no impact from this source and therefore surface water drainage is not considered further within this assessment.

#### Contamination and dewatering

14.5.3 Significant contamination has been identified at the Earl Pumping Station site, preliminary information suggests that the underlying groundwater is impacted by free phase hydrocarbons.

14.5.4 The base of the proposed main shaft would reach the underlying chalk aquifer. However, internal dewatering of diaphragm wall is proposed, which would limit the amount of dewatering required. See Section 13 of this volume for further details on the dewatering requirements. Settlement of suspended solids within the dewatering would minimise the levels of contaminants within the effluent, which tend to be associated with particulates, but additional treatment of the dewatering effluent, or remediation of groundwater, may be required.

14.5.5 It is therefore considered that there is no pollution pathway and hence no impact from dewatering.

### Construction effects

14.5.6 The assessment above has not identified any potential impacts as a result of the proposed development; therefore no significant construction effects are considered likely for the construction phase at this site.

## 14.6 Operational effects assessment

14.6.1 This section presents the operational impacts that could occur at the site. The next part of the section then goes on to identify any effects that may occur and the likely significance of these effects.

## Operational impacts

### Reduction in Earl Pumping Station CSO spills

14.6.2 Catchment modelling of the operational development case (with the operational Thames Tideway Tunnel project) predicts that by Year 1 of operation, the frequency, duration and volume of spills from the Earl Pumping Station CSO would substantially decrease (as a result of the capture of combined sewage overflows into the tunnel) as follows:

a. the CSO would spill four times in the Typical Year (26 times less than the operational base case)

b. the CSO would spill for a duration of 26 hours in the Typical Year (181 hours less than the operational base case)

c. the spill volume from the CSO would be approximately 51,000m$^3$ in the Typical Year (543,000m$^3$ less than the operational base case).

14.6.3 The frequency, duration and volume of spills at Earl Pumping Station CSO would therefore be reduced by approximately 86% as a result of the operation of the Thames Tideway Tunnel project.

14.6.4 Given the reductions in spills, the number of risk days in which river users would be exposed to pathogens in Year 1 of operation as a result of spills from the Earl Pumping Station CSO would be a maximum of 16 days in the Typical Year (a reduction of up to 104 days of risk of exposure).

14.6.5 Similarly, the tonnage of sewage derived litter from the CSO can be expected to reduce by approximately 91% from approximately 150t to approximately 13t in the Typical Year.

14.6.6 The reduction in polluting load that would be discharged from the CSO with the project in place would be as follows:

a. the CSO would discharge 6,000kg of BOD in the Typical Year (500kg less than the operational baseline)

b. the CSO would discharge 190kg of ammonia in the Typical Year (1,410kg less than the operational baseline)

c. the CSO would discharge 850kg of TKN in the Typical Year (7,050kg less than the operational baseline).

14.6.7 Catchment modelling of the 2080 development case (to account for the effects of climate change and predicted increases to population) predicts has simulated that by 2080 with the operational Thames Tideway Tunnel project, the frequency, duration and volume of the Earl Pumping Station CSO would be the following:

a. the CSO would spill on average four times per year (one less than the 2021 development case)

b. the CSO would spill for an average duration of 26 hours (one more than the 2021 development case)

c. the spill volume from the CSO would be approximately 51,000m$^3$ per year (the same as the 2021 development case).

14.6.1 In summary the model predicts that in the 2080 development case scenario the Earl Pumping Station CSO would not change spill frequency, but would increase in total spill duration and volume. These changes in spill frequency, duration and volume would be due to the impact of climate change, which is expected to lead to fewer, but more intense rainfall events during winter and drier summers.

14.6.2 Climate change is also predicted to increase average water temperatures, which combined with changes to rainfall patterns could affect water quality in the tidal Thames. As these water quality changes would be realised across the tidal Thames they have been assessed in Vol 3 Section 14 and climate change is not considered further within this site assessment.

## Operational effects

14.6.3 The potential surface water impacts identified above as a result of operation at Earl Pumping Station site have been assessed for their likely effects on WFD objective compliance, compliance with other legislation and effects on other users of the surface water.

14.6.4 The WFD objectives set out in Article 4 of the WFD are as follows:

a. WFD1 – Prevent deterioration of the status of all bodies of surface water

b. WFD2 – Protect, enhance and restore all bodies of surface water, with the aim of achieving good surface water status by 2015

c. WFD3 – Protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015

d. WFD4 – Reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances.

14.6.5 The significance of the effects has then been assessed based on the approach described in Vol 2 Section 13.5.

### Reduction in Earl Pumping Station CSO spills

14.6.6 The reduction in spills from the Earl Pumping Station CSO would represent an important contribution towards

a. meeting the requirements of the UWWTD[12] in relation to the Earl Pumping Station CSO

b. meeting the required TTSS DO standards

c. moving the tidal Thames towards its target status under the WFD both locally and throughout the tidal Thames.

14.6.7 Therefore, the reduction in spills would result in a **major beneficial** effect most notably in the context of the UWWTD. It should be noted that, as explained in Section 14.1, the water quality in the vicinity of the Earl Pumping Station CSO site also depends on the project-wide improvements, as documented in Vol 3 Section 14.

14.6.8 The associated reduction in exposure to pathogens would greatly improve the conditions for recreational users of the tidal Thames around the Earl Pumping Station CSO, allowing the tidal Thames in this location to be used more frequently with a reduced risk of exposure. This is considered to be a **moderate beneficial** effect.

14.6.9 The reduction in sewage litter discharge would also improve the aesthetic quality of the tidal Thames locally, improving conditions for recreational users. This is considered to be a **moderate beneficial** effect. As explained in Section 14.4, an assessment of the amenity effects of the sewage litter is given in Vol 3 Section 10 Socio-economics.

## 14.7 Cumulative effects assessment

14.7.1 Considerable improvements in the water quality of the tidal Thames will occur as a result of the works associated with the Lee Tunnel and sewage works upgrades. These already form part of the base case and so are not considered as part of the assessment of cumulative effects.

14.7.2 Of the phases of developments described in Vol 22 Appendix N, which could potentially give rise to cumulative construction effects with the proposed development at the Earl Pumping Station site, it is not considered that any would lead to cumulative effects on surface water. This is because no significant effects are considered likely for the construction phase.

14.7.3 It is not considered likely that phase 5 of the Surrey Canal Triangle development would give rise to cumulative construction effects with the proposed development at the Earl Pumping Station site. This is because the development is remote from the tidal Thames and this phase of the development is not of a sufficient scale such that it is not likely to generate significant effects in relation to surface water quality.

14.7.4 As explained in Section 14.3, no developments have been identified that would be under construction during Site Year 1 of operation, therefore a cumulative effects assessment has not been undertaken. No significant cumulative effects have therefore been identified for the construction or operational phases at this site. The effects on surface water would therefore remain as described in Section 14.5 and Section 14.6 above.

## 14.8 Mitigation

14.8.1 No significant adverse effects have been identified and therefore no mitigation is required.

## 14.9 Residual effects assessment

### Construction effects

14.9.1 As no mitigation measures are proposed the residual construction effects remain as described in Section 14.5. All residual effects are presented in Section 14.10.

### Operational effects

14.9.2 As no mitigation measures are proposed, the residual operational effects remain as described in Section 14.6. All residual effects are presented in Section 14.10.

## 14.10 Assessment summary

**Vol 22 Table 14.10.1 Surface water – resources construction assessment summary**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Thames Middle | The assessment has not identified any likely significant effects. | N/A | N/A | N/A |

**Vol 22 Table 14.10.2 Surface water – resources operational assessment summary**

| Receptor | Effect | Significance of effect | Mitigation | Significance of residual effect |
|---|---|---|---|---|
| Thames Middle | Compliance with UWWTD and WFD. Improved water quality in the vicinity of the Earl Pumping Station CSO by reduced pollutant loading and no reduction of DO levels due to reduced spill frequency, duration and volume from Earl Pumping Station CSO. | Major beneficial | None | Major beneficial |
| Thames Middle | Risk of exposure days to pathogens would be reduced to a maximum of 16 days in the Typical Year (a reduction of up to 104 days of risk of exposure) | Moderate beneficial | None | Moderate beneficial |
| Thames Middle | Sewage derived litter discharge at Earl Pumping Station CSO would be reduced by approximately 91% improving the aesthetic quality of the river locally. | Moderate beneficial | None | Moderate beneficial |

# References

[1] HM Government. *National Policy Statement for Waste Water: A framework document for planning decisions on nationally significant waste water* (March 2012). Available at: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf

[2] Department for Transport (DFT). *Transport Analysis Guidance* (WebTAG) (2003). Available at: http://www.dft.gov.uk/webtag/documents/overview/unit1.2.php.

[3] *The Urban Waste Water Treatment Directive, Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment.* Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0271:EN:NOT.

[4] Environment Agency. *River Basin Management Plan, Thames River Basin District* (2009).

[5] The United Kingdom Technical Advisory Group (UKTAG) to the WFD. Available at: http://www.wfduk.org/.

[6] Environment Agency. See citation above.

[7] Environment Agency. See citation above.

[8] HR Wallingford (report prepared for the Environment Agency). *Thames Estuary 2100, Morphological changes in the Thames Estuary, Technical Note EP6.8. The development of an historical sediment budget* (2006).

[9] Lane, C, Surman-Lee, S, Sellwood, J and Lee, JV. *The Thames Recreational Users Study Final Report* (2007).

[10] Lane et al. See citation above.

[11] Thames Water. *Thames Tideway Strategic Study* (February 2005).

[12] *The Urban Waste Water Treatment Directive*. See citation above.

**Thames Tideway Tunnel**
Thames Water Utilities Limited

# Application for Development Consent

Application Reference Number: WWO10001

# Environmental Statement

Doc Ref: **6.2.22**

## Volume 22: Earl Pumping Station site assessment

### Section 15: Water resources - flood risk

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

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Creating a cleaner, healthier River Thames

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# Thames Tideway Tunnel

# Environmental Statement

# Volume 22: Earl Pumping Station site assessment

# Section 15: Water resources – flood risk

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# 15 Water resources – flood risk

## 15.1 Introduction

### Background

15.1.1 This section forms a Flood Risk Assessment (FRA) for Earl Pumping Station site. This FRA has been developed in line with the requirements of the National Policy Statement (NPS) for Waste Water (Defra, 2012)[1] section 4.4 and includes a qualitative appraisal of the flood risk posed to the site, the potential impact of the development on flood risk on and off the site and an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. Further details on how the NPS requirements relevant to flood risk have been met can be found in Vol 2 Environmental assessment methodology Table 15.3.1.

15.1.2 The proposed development is described in Section 3 of this volume. Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 22 Earl Pumping Station figures).

15.1.3 A summary of the regulations and policy that have informed the assessment are presented in this section. Section 15.2 provides a summary of the elements of the proposed development relevant to flood risk. Section 15.3 provides an assessment of the flood risk to the site and elsewhere as a result of the development, during both the construction and operational phases. Section 15.4 provides details of the design measures that have been adopted within the proposals to ensure the flood risk to the site is not increased and ensure that flood risk does not increase elsewhere.

15.1.4 The assessment of flood risk should be considered in conjunction with the assessment of other water resources ie, groundwater and surface water. The assessment of effects on groundwater is presented in Section 13 Water resources – groundwater. The assessment of effects on surface water is presented in Section 14 Water resources – surface water.

15.1.5 A project-wide FRA has been undertaken and is presented in Volume 3 Project-wide assessment.

### Regulatory context

15.1.6 This FRA has been developed in line with the Waste Water NPS. The NPS seeks to ensure that where the development of new wastewater infrastructure is necessary in areas at risk of flooding, flood risk from all sources of flooding is taken into account at all stages in the planning process in order for the development to be safe without increasing flood risk elsewhere.

15.1.7 A review of planning policy relevant to the proposed development is provided in Volume 22 Appendix M.1.

### NPS Sequential and Exception Tests

15.1.8 The NPS aims to direct development towards low risk areas through the use of a sequential approach which avoids inappropriate development in areas at risk of flooding. Using this approach, preference should be given to locating projects in Flood Zone 1 although if there is no "reasonably available site" in Flood Zone 1 then projects should be located in Flood Zone 2. However if there is no "reasonably available site" in Flood Zones 1 or 2, then nationally significant wastewater infrastructure projects can be located in Flood Zone 3 subject to the Exception Test.

15.1.9 The NPS states that the Exception Test should be applied where it is not possible for the project to be located in zones of lower probability of flooding than Flood Zone 3.

15.1.10 The Exception Test is detailed in Section 4.4.15 of the NPS. The test requires overall sustainability benefits (part a) to outweigh flood risk, whilst ensuring the development is safe and does not increase flood risk elsewhere (part c) and is preferably located on previously developed land (part b).

15.1.11 The overall project is considered to pass the Sequential Test, as detailed in Vol 3. The project-wide Exception Test is also detailed in Vol 3.

15.1.12 The proposed development at Earl Pumping Station would form an integral part of the Thames Tideway Tunnel project and so would help achieve the project-wide sustainability benefits outlined in the *Sustainability statement*. Given the project-wide sustainability benefits, the proposed development is considered to satisfy part a) of the Exception Test.

15.1.13 The proposed development at Earl Pumping Station would be located on previously developed land, therefore satisfying part b) of the Exception Test.

15.1.14 This FRA shows that the proposed development would be appropriate for the area as flood risk to the development would be managed through appropriate design measures and the development would not lead to an increase in flood risk on the surrounding areas. Therefore, part c) of the Exception Test has also been met.

## 15.2 Elements of the proposed development relevant to flood risk

15.2.1 The proposed development at this site is described in Section 3 of this volume.

15.2.2 The elements of the proposed development relevant to flood risk are set out below.

### Construction

15.2.3 The construction elements of the proposed development relevant to flood risk would include:

a. The interception of the Earl pumping Station combined sewer overflow (CSO) to the main tunnel via the Greenwich connection tunnel. A CSO drop shaft would be constructed, which would be online with the proposed Greenwich connection tunnel.

b. The Earl Pumping Station CSO would be intercepted through the construction of an online interception chamber. Other structures would include culverts to modify, connect, control, ventilate, access and intercept flows from the existing Earl Pumping Station CSO and divert them into the Greenwich connection tunnel.

c. In addition to the main interception, the proposed works would demolish a 150mm surface water drain located to the west of the Earl Pumping Station site and a 300mm foul water sewer that enters the existing Earl Pumping Station on the west.

### Code of Construction Practice

15.2.4 Appropriate guidance regarding flood defence construction and emergency planning are included in the *Code of construction practice* (*CoCP) Part A.* The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements *(Part A)*, and site specific requirements for this site *(Part B)*. The relevant measures are summarised in this section.

15.2.5 The *CoCP* states that no temporary living accommodation would be permitted onsite and that an evacuation route and safe refuge should be provided in the event of a flood event.

### Operation

15.2.6 The permanent element of the proposed development relevant to flood risk would include:

a. Outfalls from the Earl Pumping Station CSO would be intercepted and diverted to the Greenwich connection tunnel.

b. The Earl Pumping Station CSO would remain operational, spilling to the tidal Thames only when the main tunnel reaches capacity or is unavailable.

c. Surface water would be attenuated onsite and restricted to 50% of the existing rates prior to being discharged to the sewer network..

## 15.3 Assessment of flood risk

### Introduction

15.3.1 The Waste Water NPS requires that all potential sources of flooding that could affect the proposed development are considered.

15.3.2 This assessment is based on a FRA screening exercise that identified relevant potential flood sources and pathways. The assessments of tidal and fluvial risk were based on the flood zones which do not take account the presence of existing defences.

15.3.3 The assessment of flood risk from the proposed development takes into account the proposed design measures detailed in Section 15.4.

15.3.4 It should be noted that due to the nature of a flood risk assessment, the risk based approach outlined in the NPPF (Communities and Local Government, 2012)[3] was considered to be preferable to the general EIA methodology described in Vol 2 Section 3. This approach is based on the probability of an event occurring as a result of the proposed development rather than a direct change in conditions. This is detailed further in the methodology (see Vol.2).

## Tidal flood risk to the proposed development

### Level of risk based on the flood zones

15.3.5 The Earl Pumping Station site is located approximately 600m west of the tidal Thames which is tidally influenced. The location of the site in relation to the flood zones is shown in Vol 22 Figure 15.3.1 (see separate volume of figures). As the site is located within Flood Zone 3a (although benefiting from the presence of flood defences) the risk of tidal flooding to the site is considered to be high (see methodology in Vol 2).

### Existing tidal defences

15.3.6 The site is protected from tidal flooding by a raised flood defence wall located along the edge of the tidal Thames as well as the Thames Tidal Barrier located further downstream.

15.3.7 The EA states that the statutory flood defence level relevant to the Earl Pumping Station site is 5.23m Above Ordinance Datum (AOD). Condition surveys of the flood defences carried out by the EA in April 2011(EA, 2012)[2] show that the flood defences in closest proximity of the site are in good condition (Grade 2).

15.3.8 The site is defended from tidal flooding to the statutory level, but floodwaters could inundate the site in the event of overtopping (for example if the Thames Barrier fails to close during a tidal event) or a failure of the flood defences as a result of a breach. The site is therefore at residual risk from tidal flooding.

15.3.9 The London Borough (LB) of Lewisham Strategic Flood Risk Assessment (SFRA) (Jacobs, 2008)[3] modelled the impact of a breach in the flood defences, located approximately 600m to the southeast of the site. The results show that in the event of breach, the site area would be subject to a ‘significant hazard’[i] (Defra and Environment Agency, 2006)[4]. However, this risk is residual and is not considered to compromise the long term operational function of the tunnels. Further detail regarding residual risk is included within para. 15.5.6 and in Vol 3.

### Tidal flood level modelling

15.3.10 The most extreme flood risk scenario that could affect the site would be combined combination of a high tide with a storm surge in the Thames Estuary. This scenario, assuming the Thames Barrier is operational is the EA’s ‘design flood’ event, a hypothetical flood representing a specific

[i]Designated using a combination of flood depth and velocity e and distance from the defence as per the Defra publication ‘Flood Risk to People’

likelihood of occurrence, in this case the 1 in 200 year (0.5% Annual Exceedance Probability [AEP][ii]) flood event.

15.3.11 The Thames Tidal Defences Joint Probability Extreme Water Level Study (EA, 2008)[5] provides modelled tidal flood levels for the 1 in 200 year (0.5% AEP) flood event for specific locations (model node locations) within the River Thames.

15.3.12 Vol 22 Table 15.3.1 presents the modelled tidal levels from this study for model node 2.42 which is the most relevant (ie, closest) to the site (Vol 22 Figure 15.3.1 see separate volume of figures). It should be noted that the water levels are expected to decrease in the future due to an improved future Thames Barrier closure rule (see Vol 2), therefore the 2005 scenario (ie, the present day scenario provided by the EA) produces the highest water level.

15.3.13 Vol 22 Table 15.3.1 also identifies that the existing defence levels at the site are above the 0.5% AEP tidal flood level; therefore the site is protected from tidal flooding to the statutory level.

**Vol 22 Table 15.3.1 Flood risk – modelled water levels**

| Return period | Flood level (mAOD) | Statutory flood defence level (mAOD) |
|---|---|---|
| 0.5% AEP (2005) | 4.83 | 5.23 |
| 0.5% AEP (2107) | 4.83 | |

## Tidal risk from the proposed development

15.3.14 The proposed works would not affect the flood defence integrity, flood defence line, scour of the foreshore or loss of volume from the Tideway, therefore the flood risk from the proposed development is not applicable.

## Fluvial flood risk to the proposed development

15.3.15 At this location along the River Thames, both fluvial and tidal inputs are component parts of the resulting water level. The impacts of flooding from the tidal influence of the tidal Thames are judged to be of greater importance than those from fluvial influences (see methodology in Vol 2). The site is protected from flooding by defences therefore the Earl Pumping Station site is considered to be located within Flood Zone 3a, and as the tidal and fluvial floodplain cannot be distinguished in this location the risk of flooding from this flood source is considered to be high. Further detail with regards to the approach followed for the assessment of fluvial flood risk is included in Vol 2.

## Fluvial flood risk from the proposed development

15.3.16 The development is not located within the undefended fluvial flood plain of the River Thames; therefore the impact of the proposed development on the fluvial flood risk is not applicable.

[ii] A flood with a 0.5% Annual Exceedance Probability (AEP) has a 1 in 200 chance of occurring in any given year.

## Surface water flood risk to the proposed development

15.3.17 Flooding of land from surface water runoff is usually caused by heavy rainfall that is unable to infiltrate into the ground or drain quickly enough into the local drainage network. Flooding can also occur at locations where the drainage network system is at full capacity and floodwater is not able to enter the system. This form of flooding often occurs in lower lying areas where the drainage system is unable to cope with the volume of water.

15.3.18 As part of the Drain London Project [iii] a Surface Water Management Plan (SWMP) was prepared for the LB of Lewisham (GLA, 2011)[6]. This identifies that the Earl Pumping Station site is not located within a Critical Drainage Area[iv], which suggests that the site is relatively less susceptible to surface water flooding than other areas in the borough. However, modelling results for a 1 in 100 year (1% AEP) rainfall event plus climate change allowance show potential surface water flooding in the southwest area of the site of up to 0.25 – 0.5m.

15.3.19 The site and surrounding area are mainly hard standing. Across the site ground levels are approximately level, varying from 1.6mAOD to 1.8mAOD. Yeoman Street, to the east of the site, slopes in a northerly direction, with levels falling from 1.8mAOD to 1.5mAOD across the width of the site. Chilton Grove, to the north of the site, slopes from 1.8mAOD in the east to 1.3mAOD to the west across the length of the site. There would be the potential for surface water to flow towards the site from Yeoman Street to the northwest, however as the site is generally at a greater elevation than the surrounding roads, there is no direct flow path towards the site.

15.3.20 As the site is located within an area of modelled potential surface water flood depths of up to 0.5m, the flood risk associated with this source is considered to be medium (see methodology in Vol 2).

## Surface water flood risk from the proposed development

15.3.21 An assessment of the likely significant effects of surface water from the Earl Pumping Station site is provided in Section 14 Water resources – surface water.

15.3.22 The NPS requires that surface water runoff on new developments is effectively managed so that the risk of surface water flooding to the surrounding area is not increased.

15.3.23 In accordance with the NPS, runoff rates following the proposed development should not be greater than the existing (pre development) rates. Furthermore, the *London Plan 2011* (GLA, 2011)[7] and the Mayor's Water Strategy (GLA, 2011)[8] set out a preferred standard of 100% attenuation and an essential standard of 50% attenuation of the peak surface water runoff rate at peak times.

[iii] A London-wide strategic surface water management study undertaken by the Greater London Authority (GLA) and London Councils.

[iv] Area susceptible to surface water flooding

15.3.24 The site is currently 100% hard standing (impermeable) land and any surface water runoff generated drains to the existing network of surface water sewers. Post development, the site would remain as 100% hard standing (impermeable). Therefore surface water runoff would need to be attenuated to meet the essential standards (50% attenuation in runoff). The required surface water attenuation volume is estimated to be approximately between $80m^3$ and $105m^3$ for a 1% AEP plus climate change rainfall event.

15.3.25 As detailed in Section 8 Land quality, there is a history of contamination on site which precludes the use of infiltration SuDS. As such, a brown roof is proposed on the drop shat and valve chamber, which would help manage surface water runoff as well as provide wider sustainability benefits. Where possible, the additional attenuation requirements would be achieved through the implementation of SuDS measures, including for instance the use of permeable surfacing around the CSO drop shaft area.

15.3.26 If required, on site underground storage would also be provided in combination with SuDS measures in order to meet the necessary attenuation requirements and meet the London's Mayor essential standards.

15.3.27 The attenuated surface water runoff would be discharged to the sewers network.

15.3.28 Following the implementation of the above drainage measures the risk of surface water flooding from the proposed development to the surrounding area is considered to remain unchanged.

## Groundwater flood risk to the proposed development

15.3.29 Groundwater flooding occurs where groundwater levels rise above ground surface levels. Groundwater levels have been recorded by Thames Water in a series of boreholes located within 1km of the site. The groundwater levels in the upper aquifer (river terrace deposits) have an approximate average level of 2.7m below ground level (bgl). The water levels of the upper aquifer are confined by the overlying alluvium and made ground layers.

15.3.30 As the upper aquifer is confined, there is no pathway for groundwater to reach the surface of the site. There is therefore no risk of groundwater flooding to the site (see methodology in Vol 2).

## Groundwater flood risk from the proposed development

15.3.31 An assessment of the likely effects on groundwater at the Earl Pumping Station site is provided in Section 13 Water resources – groundwater.

15.3.32 The CSO drop shaft would pass through made ground, alluvium, river terrace deposits, London Clay, Harwich Formation and the Lambeth Group. The CSO drop shaft would pass through the upper and lower aquifers. Internal dewatering is anticipated during the construction phase to manage the groundwater levels and reduce the risk of flooding from this source. The internal dewatering would yield considerably smaller quantities of groundwater in comparison to external dewatering.

Groundwater brought to the surface as a result of dewatering during construction would be pumped from the construction site to an appropriate sewer, following treatment.

15.3.33 The presence of the CSO drop shaft creates a physical barrier and has been assessed in Section 13 Water resources – groundwater as having a predicted rise in water levels (approximately 0.15m). This would result in an increased hydraulic pressure within the confined unit rather than an increase in the water table. Therefore there is no pathway for groundwater to reach the site, and no risk of an increase in groundwater flooding to the site as a result of the development.

### Sewers flood risk to the proposed development

15.3.34 The Earl Storm Relief Sewer (2591mm diameter) flows from the southwest to the Earl Pumping Station. Under dry flow conditions, sewage is pumped, via the Earl Sewer (Croft Street Section), to the Low Level Sewer No. 1 – Bermondsey Branch where it drains to the Greenwich Pumping Station. During storm conditions, high levels of flow are pumped from the Earl Pumping Station, via the Earl Storm Outlet (2743mm diameter), to the River Thames.

15.3.35 The Low Level Sewer No 1 – Bermondsey Branch flows in Evelyn Street (diameter of 1676mm). At high flows the Low Level Sewer No 1 – Bermondsey Branch, can spill into the Earl Storm Relief Sewer at an overflow weir in the junction of Chilton Grove and Evelyn Street.

15.3.36 A combined sewer (300mm diameter) runs in an anticlockwise direction in the roads surrounding the Earl Pumping Station Site. This connects to the Earl Sewer (Croft Street Section) in Evelyn Street.

15.3.37 In the event that the capacity of the pumps or the combined network is exceeded, flood water containing foul water could surcharge through outlets such as manholes located along the length of the sewer. The pathway for this flood water would be in a northerly direction, across the site and towards the River Thames. As the ground levels on the site are lower than those adjacent to the river, in the event of significant sewer surcharging, some ponding on the site would be anticipated.

15.3.38 Thames Water sewer flooding records (Thames Water, 2012)[9] show that there are no records of sewer flooding resulting from the surcharging of sewers within 200m of the site since 1990.

15.3.39 As there have been no sewer flooding incidents within the vicinity of the site, the flood risk from this source is considered to be low.

### Sewers flood risk from the proposed development

15.3.40 Following the construction of the proposed development, the Earl Storm Relief Sewer would be intercepted, and flows diverted to the Greenwich connection tunnel. An interception chamber would be constructed online of the Earl Storm Relief Sewer and would divert flows, via a connection culvert and CSO drop shaft to the Greenwich connection tunnel. The flood risk during the construction phase would be managed using design measures described in section 15.4.

15.3.41 The interceptionchamber and connections have been designed so that there is no increased flooding risk in the existing system for the 1 in 15 year design storm when compared to the base case scenario[v]. Further detail is provided in Vol 3 Section 15.

15.3.42 At present during high flows, sewage is pumped via the Earl Storm Outlet to the River Thames. Following construction, sewage would be pumped to the tidal Thames via the Earl Storm Outlet when the capacity of the Greenwich connection tunnel and the main tunnel is reached or the tunnel is unavailable,

15.3.43 Following the construction of the proposed development the risk of flooding from this source would be unchanged and therefore would remain low.

### Artificial sources flood risk to the proposed development

15.3.44 The Greenland Dock, located to the north of the site poses a potential flood risk to the Earl Pumping Station site. Water levels in the Dock are controlled by a series of locks and gates connected to the River Thames.

15.3.45 Discussions with the EA confirmed that it can be assumed that the Greenland Dock is protected up to the 0.1% AEP standard.

15.3.46 Due to the connection with the tidal reaches of the River Thames (tidal Thames), there is a residual risk of tidal flooding if a breach in the flood defences or a failure of the Thames Barrier downstream were to occur. Therefore the flood risk to the development site is considered to be high and residual.

### Artificial sources flood risk from the proposed development

15.3.47 The proposed development would not impact on the flood defences, or flood storage relating to Greenland Dock. Therefore the flood risk from the development on this receptor is not applicable.

## 15.4 Design measures

15.4.1 Measures have been incorporated into the design of the proposed development to ensure that the risk of flooding to and from the site and surrounding areas is not increased during the construction and operational phases. These measures are described below although many have already been referred to in the preceding section.

### Tidal and fluvial

#### Construction

##### Emergency plan

15.4.2 Appropriate emergency planning procedures would be adopted by the contractor during the construction phase to mitigate the potential

[v] The base case scenario comprises the sewage treatment works (STW) Improvements and Lee Tunnel in 2020s.

consequences in the event of a breach in the flood defence wall at the site or a failure of the Thames Barrier. Further information is included within the *CoCP*.

### Operation

#### Emergency plan

15.4.3 During the operational phase the site would not be permanently staffed. The site would be subject to occasional visits from maintenance personnel. An emergency plan would only be required for staff undertaking maintenance visits.

## Surface water

### Construction

15.4.4 In accordance with the *CoCP* all site drainage during construction would be drained and discharged to mains foul or combined sewers and where this is not practicable (for example due to risk of blockage due to excessive sediment loads), the site would be drained such that accumulating surface water would be directed to holding or settling tanks, separators and other measures prior to discharge to the combined or surface water drains. Foul drainage from the site welfare facilities would be connected to the mains foul or combined sewer. This approach would ensure that the risk of surface water flooding is managed during construction but would not reduce the overall level of flood risk associated with surface water.

### Operation

#### Surface water management

15.4.5 As described in para. 15.3.25 surface water would be attenuated on site to meet the Mayor's Essential Standard for the site. Following attenuation, surface water would be discharged to the existing drainage network.

## Groundwater

15.4.6 Groundwater monitoring is proposed during construction and operation. Further measures regarding dewatering and maintaining groundwater levels are described in Section 13 Water resources – groundwater.

## Sewers

### Construction

15.4.7 The Earl Storm Relief Sewer would be intercepted at the Earl Pumping Station site (downstream of the dry weather flows pumping station) and the flows diverted to the Greenwich connection tunnel. The Earl Storm Relief Sewer would be maintained throughout construction and would be intercepted following the completion of the main tunnel and the Greenwich connection tunnel.

15.4.8 To protect the Earl Storm Relief Sewer, the interception chamber would be constructed around the existing sewer so that it would not be exposed at any time. If required, a lining would be inserted to reinforce the sewer pipe to contain any sewage flow and the pipe subsequently broken out as required for the interception. Following interception, the lining would be removed.

15.4.9 Where required, building works would be diverted and protection applied to ensure the integrity of other surface water, foul and combined sewers that intersect with the proposed development.

### Operation

15.4.10 Sewage would be pumped to the tidal Thames via the Earl Strom Outlet when the capacity of the tunnels is reached or the tunnels are unavailable, ensuring no increase in flood risk compared to the existing scenario.

## 15.5 Assessment summary

### Flood risk

15.5.1 The Earl Pumping Station site is located in Flood Zone 3a associated with the tidal Thames and benefits from the presence of flood defences.

15.5.2 In line with NPS, this FRA shows that the proposed development would be appropriate for the area as flood risk to the development would remain unchanged as it would be managed through appropriate design measures and the development would not lead to an increase in flood risk on the surrounding areas. Therefore, no significant flood risk effects are likely provides a summary of the findings of the FRA

### Residual risk to the development

15.5.3 The residual risk to the site is the risk that remains after all design measures have been incorporated.

15.5.4 The site is at residual risk of tidal flooding in the event of a breach in the local flood defence wall along the edge of the Thames (including that associated with the Greenland Docks) or overtopping of the defence wall as a result of a failure of the Thames Barrier.

15.5.5 In the very unlikely event of a mechanical failure at the pumping station, there is potential for sewage to back up within the system and surcharge through manholes and gullies.

15.5.6 It is considered that the consequence of a breach or failure of flood defences or a failure of the pumping station, would not compromise the long term operational function of the tunnel and therefore no additional mitigation measures above those outlined above are proposed. Further detail is provided in Vol 3.

### Residual risk from the development

15.5.7 Following the incorporation of the design measures outlined in Vol 22 Table 15.5.1, the level of residual risk from the development to adjacent areas would remain unchanged. The project-wide residual risks are discussed in Vol 3.

**Vol 22 Table 15.5.1 Flood risk – FRA summary**

| Source | Pathway | Current flood risk to the proposed development | Design measures (construction and operation) | Flood risk from the proposed development (post design measures) | Flood risk to the proposed development post design measures |
|---|---|---|---|---|---|
| Tidal | Breach/ overtopping of the tidal Thames flood defences | High (but residual only) | Emergency Plan | No increase in tidal flood risk as a result of proposed development. | High (but residual only) |
| Fluvial | Breach/ overtopping of the tidal Thames flood defences | High (but residual only) | Emergency Plan | No increase in fluvial flood risk as a result of proposed development. | High (but residual only) |
| Surface water | Surrounding area | Medium | Site drainage in accordance with CoCP during construction.<br>Surface water runoff attenuated on site to meet London's Mayor essential standards.<br>Discharge of surface water to the existing sewer network. | No increase in surface water flood risk as a result of proposed development. | Medium |
| Groundwater | Underlying geology and groundwater levels restricted pathway | No risk | Dewatering during construction.<br>Monitoring proposed during construction and operation. | No increase in groundwater flood risk as a result of proposed | No risk |

| Source | Pathway | Current flood risk to the proposed development | Design measures (construction and operation) | Flood risk from the proposed development (post design measures) | Flood risk to the proposed development post design measures |
|---|---|---|---|---|---|
| Sewers | Local drainage system | Low | Storm Relief Sewer would be maintained and unexposed during construction.<br>All flows currently pumped by Earl Pumping Station would be diverted to the main tunnel. | No increase in sewers flood risk as a result of proposed | Low |
| Artificial sources | Greenland Dock | High (but residual only) | None required | Not applicable | High (but residual only) |

** Definitions of these classifications are included in Vol 2*
*() indicate the flood risk is residual ie in the event of a failure or overtopping of flood defences*

# References

[1] Department of Environment, Food and Rural Affairs (Defra), *National Planning Policy for Waste Water.* (February 2012).

[2] Environment Agency. *Flood Defence Data*. (received January 2012).

[3] Jacobs *London Borough of Lewisham Level 1 Strategic Flood Risk Assessment.* (July 2008).

[4] Defra and Environment Agency. *Flood Risk to People, The Flood Risk to People Methodology (FD2321/TR1)*(March 2006).

[5] Environment Agency. *Thames Tidal Defences Joint Probability Extreme Water Levels 2008 Final Modelling Report*. (April 2008).

[6] Greater London Authority. *Surface Water Management Plan for the London Borough of Lewisham. (August, 2011).*

[7] Greater London Authority. *The London Plan Spatial Development Strategy for Greater London*. (July 2011).

[8] Mayor of London. Greater London Authority. *Securing London's Water Future. The Mayor's Water Strategy.* (October 2011).

[9] Thames Water. *Sewer Flood Records*. (received June 2012).

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