Thames Tideway Tunnel
Thames Water Utilities Limited

Development Consent Order

Application Reference Number: WWO10001

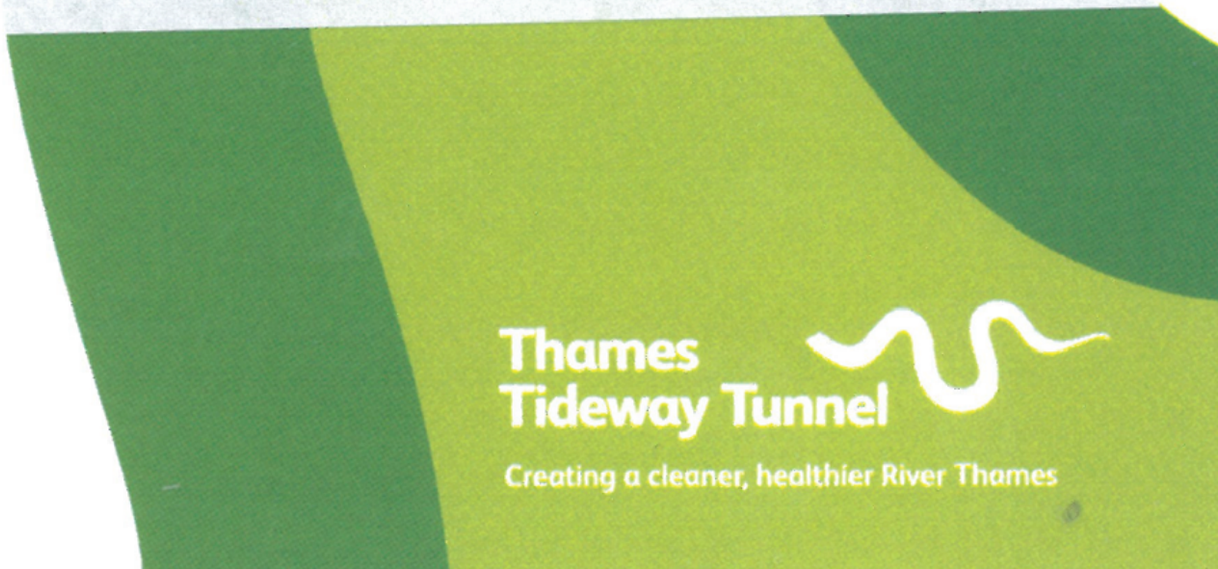
Documents for Certification
September 2014

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

Lindsay Speed

Sarah Fairbrother

September 2014



Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

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

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Environmental Statement

Volume 23: Deptford Church Street site assessment

Errata

Section	Paragraph No.	Page No.	Errata / Clarification
Section 12 Transport	12.5.25	36	Incorrect reference to eight on-street parking spaces. Text should read “The construction site would require the temporary restriction of four on-street parking spaces along Coffey Street and the prohibition of unmarked kerbside parking capacity along Crossfield Street during construction to enable lorries to access and leave the site...”.

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Environmental Statement

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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 Deptford Church Street site.

1.1.2 The proposal at this site is to intercept the existing combined sewer overflow (CSO), which runs along Deptford Church Street and currently discharges approximately 36 times in a typical year. The total volume discharged is approximately 1,470,000m^3 in each typical year. This would require a CSO drop shaft to be constructed to join to the proposed Greenwich connection tunnel.

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 23 Deptford Church Street figures and Vol 23 Deptford Church Street appendices). In addition, there is a separate glossary and abbreviations document which explains technical terms used within this assessment.

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Section 2: Site context

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2 Site context

2.1.1 The proposed development site is located within the London Borough (LB) of Lewisham. It comprises a main site made up of public open space and four small highway work sites. The site's extent is defined by the limits of land to be acquired or used (LLAU) and would cover an area of approximately 1.2 hectares for the main site and 0.02 hectares for each highway works site. The site context and location are indicated in Vol 23 Figure 2.1.1 (see separate volume of figures).

2.1.2 The site is triangular in shape bounded to the north by the Grade I listed St Paul's Church, to the east by Deptford Church Street (A2209), beyond which is the Sue Godfrey Local Nature Reserve and, to the southwest by St Joseph's Roman Catholic Primary School. The nearest residences are to the east of the site over Deptford Church Street at Congers House, Farrer House and Berthon Street. To the west of the site are the rear façades of the mixed residential and commercial properties on Deptford High Street. Vol 23 Plate 2.1.1 below shows an aerial view of the site.

Vol 23 Plate 2.1.1 Deptford Church Street – aerial photograph

2.1.3 Existing access to the site is from Coffey Street and Crossfield Street. The closest railway station is Deptford National Rail Station, located approximately 300m to the west of the site. The nearest bus stops to the sites are located adjacent to the site on Deptford Church Street. There are no Public Rights of Way (PRoW) within the site.

2.1.4 Within the main site there is an area of public open space, with a number of mature trees (see Vol 23 Plate 2.1.2). The general pattern of existing

land uses within and around the site shown in Vol 23 Figure 2.1.2 (see separate volume of figures).

Vol 23 Plate 2.1.2 Deptford Church Street – view of site from within open space

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

a. residential:
   i Residential properties 36m to the east of the hoarding.

b. educational
   i St Joseph's Roman Catholic (RC) primary school – 10m to the west of hoarding
   ii Tidemill Primary School Primary School – 50m southeast of the hoarding

c. commercial
   i Mechanics workshop, plumbers merchants, packaging/distribution business –10m south of the hoarding

d. recreational
   i Playground – 85m to the north of the hoarding beyond churchyard,
   ii Swimming pool – 30m to the south of the hoarding beyond railway viaduct.

e. other

i St Paul's church – 30m to the north of hoarding (see Vol 23 Plate 2.1.3).

2.1.6 Environmental designations for the site and immediate surrounds are shown in Vol 23 Figure 2.1.3 (see separate volume of figures).

Vol 23 Plate 2.1.3 Deptford Church Street – view of St Paul's Church from junction of Coffey Street and Crossfield Street

2.1.7 A Grade II listed mid-19th century London to Greenwich Railway viaduct is located within the south-eastern corner of the site. Listed buildings close to the site include the Parish Church of St Paul's, adjacent to the north of the site, which is a Grade I listed building, constructed in 1730 (Vol 23 Plate 2.1.3). The Grade II listed walls of its churchyard are approximately 25m to the northeast of the site, across Coffey Street. The walls of the former graveyard belonging to the Old Baptist Chapel are also Grade II listed and lie immediately adjacent to the northern boundary of the site.

2.1.8 The site lies within the St Paul's Conservation Area and is adjacent to the Deptford High Street Conservation Area to the west and the Deptford Creekside Conservation Area to the east. It also sits within Upper Deptford Archaeological Priority Area (APA) which was designated by the LB of Lewisham.

2.1.9 The St Paul's Churchyard and Crossfield Open Space Site of Importance for Nature Conservation (SINC) (Local Importance) covers the site and is designated based on the diversity of flora and local nesting habitat that the area provides particularly in the churchyard. The area also makes up part of the LB of Lewisham's open space plan and provides an amenity resource for the local community.

2.1.10 There are no tree preservations orders (TPOs) on the site; however the site contains a number of semi-mature trees which are protected under the Conservation Area designation.

2.1.11 The site is within the Lewisham air quality management area (AQMA), declared for particulate matter (PM_{10}) and nitrogen dioxide (NO_2).

2.1.12 Off site there have been a number of industrial and commercial properties including wharfs, oil refineries and gas works that potentially represent sources of contamination. Local geology comprises superficial deposits and made ground, River Terrace Deposits, London clay, Harwich formation, Lambeth group, Thanet sand (secondary aquifer), and Chalk at depth (principal aquifer).

2.1.13 The site is situated approximately 250m west of the tidal stretch of the Ravensbourne River (known as Deptford Creek) and approximately 600m south of the River Thames, both of which are part of the River Thames and Tidal Tributaries SINC. The majority of the site lies within Flood Zones 2 and 1, with the far south east corner of the site located within Flood Zone 3.

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Volume 23: Deptford Church Street site assessment

Section 3: Proposed development

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3 Proposed development

3.1 Overview

3.1.1 The proposed development at Deptford Church Street would intercept the existing Deptford Storm Relief CSO. A CSO drop shaft would be constructed and the base of the shaft would join up with the long connection tunnel from Greenwich Pumping Station. There would also be an interception chamber, hydraulic structures/chambers with access cover(s) and other structures including culverts to modify, connect, control, ventilate, access and intercept flows from the existing Deptford Storm Relief Sewer 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 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 includes 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 development 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 development 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 23 Appendix N. The methodology for identifying these schemes is explained in Volume 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 23 Table 3.2.1 below sets out documents and plans for which consent is sought and which have been assessed.

Vol 23 Table 3.2.1 Deptford Church Street − 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 23 Deptford Church Street figures – Section 1
Demolition and site clearance plan	For approval	Vol 23 Deptford Church Street figures – Section 1
Access plan	For approval	Vol 23 Deptford Church Street figures – Section 1
Proposed landscape plan	Illustrative only, save for the scale of the above ground structures which is indicative	Vol 23 Deptford Church Street figures – Section 1
Design Principles: Generic	For approval	*Design Principles* report Section 3 (see Vol 1 Appendix B)
Design Principles: Site Specific principles (Deptford Church Street)	For approval	*Design Principles* report Section 4.19 (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 (Deptford Church Street)	For approval	*CoCP* Part B Deptford Church Street (see Vol 1 Appendix A)

Description of the proposed works

3.2.3 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 nationally significant infrastructure project (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).

3.2.4 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.

3.2.5 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

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

a. **Work No. 22a:** Deptford Church Street CSO drop shaft – A shaft with an internal diameter of 17 metres and a depth (to invert level) of 48 metres.

Associated development

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

a. **Work No. 22b**: Deptford Church Street associated development – Works to intercept and divert flow from the Deptford Storm Relief CSO to the Deptford Church Street CSO drop shaft (Work No. 22a) and into the Greenwich connection tunnel (Work No. 20) including the following above and below ground works and structures:

   i demolition of existing wall

   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 structures for air management equipment including filters and ventilation columns and associated below ground ducts and chambers

   iv construction of electrical and control kiosks

   v construction of pits, chambers, ducts and pipes for cables, hydraulic pipelines, utility connections, utility diversions and drainage, including facilities for drainage attenuation

   vi construction of temporary and then permanent access from Coffey Street and Crossfield Street

   vii temporary alterations to highway layout of Crossfield Street

viii attention to carriageway of Deptford Church Street, temporary relocation of existing pedestrian crossing and bus stops on Deptford Church Street, closure of bus lanes and removal of the central reservation.

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

a. Ventilation column(s) serving the drop shaft = 8m (with a minimum height of 6.0m)

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

c. Electrical and control kiosk = 3.0m (with a minimum height of 2.8m)

3.2.9 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.

3.2.10 The works defined by bullets c, k, m, o and p (in the list above) are not considered likely to be applicable to the works proposed to this site. It is also considered unlikely that the works at this site would require the removal or creation of temporary coach parking bays (see bullet d).

Ancillary works

3.2.11 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*.

3.2.12 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

3.2.13 The works defined by bullets b, c, d and h (in the list above) are not considered likely to be applicable to the works proposed to this site.

Design principles

3.2.14 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).

3.2.15 The generic principles include principles for the integration of functional components and also principles for heritage, in-river structures, landscape, lighting and site drainage.

3.2.16 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.

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

Site features and landscaping

3.2.18 The above-ground structures are shown at indicative scale on the Proposed landscape plan (see separate volume of figures – Section 1) and the scales of these structures (in addition to the defined heights) have been considered within the assessments as appropriate. 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).

3.2.19 All other features on the Proposed landscape plan are illustrative only and have not been assessed. The landscaping proposals for approval for this site are provided in the site-specific design principles for this site (*Design Principles* report Section 4.19) (as summarised above).

Code of Construction Practice

3.2.20 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* is provided in Vol 1 Appendix A and 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.

3.2.21 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 Section 3.3 although further details on the measures within the *CoCP* Part B Deptford Church Street 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 only 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 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 Environment Agency (EA) (including flood defence consents, abstraction licenses and discharge consents) and the Port of London Authority (PLA) (including river works licenses) as appropriate.

Assumed construction programme and working hours

3.3.5 Construction at this site would be likely to commence in 2016 (Site Year 1) and be completed by 2020 (Site Year 4). The site would only become operational in 2023 when the Thames Tideway Tunnel project as a whole becomes operational.

3.3.6 Construction at Deptford Church Street is anticipated to take approximately three and a half years and would involve the following phases (with some overlaps):

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

b. Site Years 1 to 2 – CSO drop shaft construction (approximately 12 months)

c. Site Years 2 to 3 – Construction of other structures (approximately 20 months)

d. Site Years 3 to 4 – Completion of works and site restoration (approximately 6 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 Extended working hours are 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. It is assumed that extended hours would be required for approximately twice a week during diaphragm walling for a total duration of approximately four months, and for once a month during other major concrete pours. The exact timing of any extended hours of working would be consulted on, and notified to the LB of Lewisham. During these periods only those activities directly connected with the task would be permitted within the varied hours.

Typical construction activities

3.3.9 Vol 23 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 23 Table 3.3.1 Deptford Church Street − construction phase plans

Plan title	Activities	Status	Location
Construction phases – phase 1	Site setup and drop shaft construction	Illustrative	Vol 23 Deptford Church Street figures – Section 1
Construction phases – phase 2	Construction of other structures	Illustrative	Vol 23 Deptford Church Street figures – Section 1

3.3.10 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.

3.3.11 The following physical construction works 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

3.3.12 All of the trees on the site would need to be removed as would the existing wall which runs from north to south across the site. It is assumed that the demolition and site clearance would take approximately three months. The extent of demolition and site clearance works are shown on the Demolition and site clearance plan (see separate volume of figures – Section 1). 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 would occur within this earliest phase of construction and that any associated lorry movements would be substantially lower than the subsequent peak during the main construction phases.

3.3.13 Prior to any works commencing the site boundary would be established and secured. The boundary would be built to the heights specified in the *CoCP* Part B Deptford Church Street Section 4. Welfare and office facilities would be set up. Water and power connection to the site would also be established.

Shaft construction

3.3.14 Once the site has been prepared as described above, plant and material storage areas, an excavated material handling area and delivery vehicle turning area would be set up on site. Major plant required for the CSO drop shaft construction would include cranes, a diaphragm wall rig, bentonite silos, water tanks, a mixing pan, a compressor, an air receiver, an excavator and a dumper.

3.3.15 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 the excavation, steel bar reinforcement cages would be lowered in before concrete would be pumped into the trench in order to displace the bentonite and form a wall panel.

3.3.16 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.

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

3.3.18 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.

3.3.19 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 excavated material 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 slab would be formed at the base of the drop shaft.

3.3.20 It is anticipated that dewatering would be required. Dewatering wells would be drilled from within the drop shaft (a process known as 'internal dewatering') and groundwater extracted via pumps. These pumps would be operational during drop shaft excavation. For the purpose of this assessment it has been assumed that the pumps would be maintained to ease the reception and launch of the tunnel boring machine (TBM) en route to Chambers Wharf from Greenwich Pumping Station. It is assumed that extracted groundwater would be discharged via the existing CSO and then into the tidal Thames after being treated through a settlement system. Extracted groundwater would be sampled on a regular basis to check water quality.

3.3.21 It is anticipated that ground treatment would be required within the Chalk beneath the base slab and that treated blocks would be constructed either side of the drop shaft to facilitate TBM break in / break out.

Tunnel construction

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

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

Secondary lining of shaft

3.3.24 It is assumed that the lining of the CSO drop shaft would be made of reinforced concrete placed inside the 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 shaft.

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

Construction of other structures

3.3.26 Air management structures comprising an underground chamber, ventilation columns and underground louvre chambers for ventilation control and an electrical and control kiosk would be constructed on the site. In addition an interception chamber, culvert and valve chamber would intercept the sewer running along Deptford Church Street.

3.3.27 Sheet pile walls would be used to provide ground support within which the underground chambers would be constructed. Walls would be constructed to depth to minimise groundwater ingress into the excavation, but small pumps would be utilised to manage any ground water that does seep through. The pumps would discharge flow to the sewer after being treated through a settlement system.

3.3.28 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 would be delivered to site and either 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.

3.3.29 For the above ground structures, including the kiosk and ventilation columns, the components would be delivered by road and assembled on site using suitable lifting equipment.

Completion of works and site restoration

3.3.30 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

3.3.31 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 48,000 tonnes, the main elements of which would comprise approximately 10,000 tonnes of mixed materials from the diaphragm wall construction, 11,000 tonnes of Made ground, 10,000 tonnes of Thanet sands, 4,000 tonnes from the Lambeth group and 12,000 tonnes of chalk.

3.3.32 In addition, it is estimated that approximately 900 tonnes of construction waste would be generated including 600 tonnes of concrete, 70 tonnes of imported fill and 200 tonnes of other material.

3.3.33 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

3.3.34 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'.

3.3.35 The highest lorry movements (peak vehicle 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 32 HGV lorries, equivalent to 64 movements per day. It is estimated that total vehicle numbers for this site would be in the order of 8,700 HGV lorries, equivalent to 17,400 movements over the construction period.

3.3.36 Construction lorries would take the route of minimum impact to/from the Transport for London Route Network (TLRN). It is envisaged that lorries would access from the A2 – Deptford Bridge/Broadway, A2209 - Deptford Church Street, and locally via Crossfield Street. Egress would be provided through Coffey Street, A2209 – Deptford Church Street, and onto the A200 – Creek Road/Evelyn Street.

3.3.37 To facilitate the construction vehicles movement and to provide a safe traffic system on site, a one-way loop system around the working site would be created by opening up the end of Crossfield Street and making it a one-way road west-bound. Construction vehicles would be able to enter Crossfield Street from Deptford Church Street, circulate around the construction site and leave via Coffey Street which would also become a one way road for construction vehicles, east-bound. To provide both access/egress points, the kerbs would require dropping on both ends. Part of the cobbled surface within the southern part of the site, along Crossfield Street, would be removed.

3.3.38 The above arrangement would be in place throughout the entire construction period.

3.3.39 During the construction of the interception chamber, the two northbound lanes of Deptford Church Street would need to be temporarily suspended and traffic diverted onto the existing southbound carriageway. A single lane in each direction would be provided on the eastern carriageway during this phase of construction.

3.3.40 To enable the works on site, the current northbound bus and traffic lane located on Deptford Church Street between Crossfield Street and Coffey Street would require closure for approximately 12 months. Northbound traffic would be diverted onto the other side of Deptford Church Street enabling single lane traffic in each direction. This would require the current southbound bus lane to be suspended for this short stretch of the network and the central reserve to be temporarily dismantled.

3.3.41 It is intended that the signalised pedestrian crossing linking Bronze/Berthon Street with Coffey Street would be relocated further north during the second phase of the works. Two bus stops located north of the site on would also be relocated further north. In addition, bus stops located south of the site on would also be relocated further south.

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

3.3.43 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 current 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 CSO discharges would be reduced from 36 spill events to approximately four times per typical year at an average rate of 163,000m^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 work description 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, the electrical and control kiosk are defined and 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 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 may affect the dispersion of potentially malodorous air; this lower height limit has therefore 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.

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

3.4.9 Once constructed and operational the structures listed in the following sections would remain on site.

Shaft

3.4.10 The location, diameter and depth of the CSO drop shaft are described in Section 3.2. The drop shaft would be finished approximately 600mm below ground level, and generally covered with grass, with some covers exposed to allow access and inspection.

Chambers and culverts

3.4.11 The interception chamber, culvert and valve chamber would be below ground. There would be covers on top of the chambers to allow access and inspection.

Air management structures

3.4.12 The heights and locations of above ground air management structures, which comprise the ventilation columns, are defined in Section 3.2. In addition to these structures, an underground air treatment chamber would contain an air management filter and would be connected to the ventilation columns. The air treatment chamber would have ground level covers to allow access and inspection.

Electrical and control kiosk

3.4.13 The height and location of the above ground electrical and control kiosk are defined in Section 3.2.

Permanent restoration and landscaping

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

Typical maintenance regime

3.4.15 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 projects included in the assessment. A schedule is provided in Vol 23 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 Deptford Church Street are listed below. A map showing their location is included in Vol 23 Figure 3.5.1 (see separate volume of figures).

a. Giffin Street Regeneration Area, Giffin Street
b. Creekside Village East (Thanet Wharf), Copperas Street
c. Greenwich Reach East
d. Site of old Seagar Distillery and Norfolk House, 4-12 Deptford Bridge
e. Greenwich Industrial Estate (land bounded by Norman Road, Greenwich High Road and Waller Way)
f. Convoys Wharf
g. Bardsley Lane (land at Creek Road/Bardsley Lane)
h. Land opposite North Greenwich Pier, Greenwich Peninsula
i. Land at Stockwell Street and John Humphries House, Greenwich
j. Heathside and Lethbridge Estate

3.6 On-site alternatives

3.6.1 Project-wide and site selection alternatives are addressed in Volume 1 Section 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 23 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 23 Table 3.6.1 Deptford Church Street − on-site alternatives

Item	Alternatives considered	Reasons not progressed
Existing wall which currently divides the open space	Retain/reinstatement of the existing wall and provide openings along it.	• The wall is not statutorily or locally listed therefore retention is not essential. • The wall currently divides the space and its removal would enable the space to be opened up.
Location of ventilation columns serving the drop shaft	Ventilation columns located in the northern section of the site (south of Coffey Street).	• Would mean that the columns would be located closer to the Grade I listed St Paul's church. • LB Lewisham preference for columns to be located away from the church (ie, proposed location to the south of the site towards Crossfield Street).
CSO drop shaft location	Drop shaft located north west of the open space (closer to Coffey Street)	• Considered that this would result in a Greenwich connection tunnel alignment that would pose a risk to the Grade I listed church.
Site boundary/ LLAU	Smaller LLAU that only extends to the western parameter of the open space (ie does not include the existing pedestrian refuge located on Crossfield Street)	• Extension of LLAU to include pedestrian refuge located on Crossfield Street enables provision of an alternative fire assembly point for St Joseph's Catholic Primary School.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 4: Air quality and odour

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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 23: Deptford Church Street 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 Deptford Church Street 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. emissions from construction plant (air quality)

c. construction-generated dust (air quality)

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

4.1.3 Each of these potential impacts is considered within the assessment. As a result the construction assessment for the Deptford Church Street site comprises three separate components: effects on local air quality from construction road traffic; effects on local air quality from construction plant; and effects from construction dust. 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 (Volume 23 Deptford Church Street figures). Appendices supporting this site assessment are contained in Vol 23 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 Deptford Church Street 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 64 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 Deptford Church Street site in the peak construction year and associated emissions data are presented in Vol 23 Appendix B.4.

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

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 Deptford Church Street site there would be approximately 270m^3 of demolition material generated while the amount of amount of material moved during the earthworks would be approximately 50,000 tonnes. The volume of building material used during construction would be approximately 13,000m^3.

Code of construction practice

4.2.11 Appropriate dust and emission control measures are included in the *Code of Construction Practice (CoCP)*[ii] *Part A* (Section 7) in accordance with the

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

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 Deptford Church Street site.

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

Operation

4.2.13 Ventilation structures would treat air released from the tunnel. The air would be treated by passing air through four carbon filters housed in a below ground air treatment chamber. Natural pressure during tunnel filling would allow air to pass passively without the need for fans. The capacity of each passive filter would be 3.0m^3/s. The maximum air release rate through each filter during a typical year is expected to be 2.4m^3/s, therefore all air in a typical year would be treated through the passive filter. No nuisance odours are therefore expected.

4.2.14 Air would be released from the ventilation columns 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

4.2.15 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. Full details of the Thames Tideway Tunnel project ventilation system can be found in the *Air Management Plan*.

4.3 Assessment methodology

Engagement

4.3.1 Vol 2 Section 4.2 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of air quality and odour are presented here (Vol 23 Table 4.8.1).

Vol 23 Table 4.8.1 Air quality and odour – stakeholder engagement

Organisation	Comment	Response
LB of Lewisham, Position Paper,	Idling of construction vehicle and plant must not be allowed at sites in LB of Lewisham.	Idling would be dealt with through the *CoCP Part A*.

[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).

Organisation	Comment	Response
January 2011		
LB of Lewisham, April 2011	Agree monitoring locations with LB Lewisham	Locations agreed with LB of Lewisham Senior Air Quality Officer.
LB of Lewisham, July 2012	Odour complaints in the area should be considered	No odour complaints; confirmed by LB of Lewisham Environmental Protection Officer.
LB of Lewisham, Phase two consultation, February 2012	There are two Primary Schools close-by the proposed site; St Joseph's Roman Catholic Primary School is opposite the site and the new Tidemill Academy (due to be completed this year) is very near. In addition, students attending Addey and Stanhope School who live in the area may also have their journey to and from school affected. Officers have concerns about the effects of noise, vibration and dust on the School Children.	Both St Joseph's Roman Catholic (RC) Primary School and new Tidemill Academy have been assessed as specific receptors in the local air quality and construction dust assessment. The results are summarised in Section 4.10.
LB of Lewisham, Phase two consultation, February 2012	The schools are located in Evelyn Ward which is a very deprived part of the Borough and in the government's Index of Deprivation is recorded as amongst the 10% most deprived areas in England. The proposed works are for at least a four and a half year period which represents the majority period of primary school attendance. It is considered that the potential impact on the education of children in an already deprived area is unacceptable and is sufficient reason not to use this site.	Both St Joseph's RC Primary School and new Tidemill Academy have been assessed as specific receptors in the local air quality and construction dust assessment. The results are summarised in Section 4.10.
LB of Lewisham, Phase two consultation, February 2012	In addition to this there will be a severe impact on the life of the school and potentially on teaching and learning. Both indoor and outdoor learning will be impacted by noise and air quality. Children suffering from Asthma may be affected.	Both St Joseph's RC Primary School and new Tidemill Academy have been assessed as specific receptors in the local air quality and construction dust assessment. The results are summarised in Section 4.10. The UK

Organisation	Comment	Response
		air quality objectives have been set to protect the health of the most vulnerable members of society such as asthma sufferers.
LB of Lewisham, Phase two consultation, February 2012	The DCS 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 impacts of the construction/excavation activities and the HGVs using the site is likely to result in an increase in particulate matter. The transport proposals are likely to cause significant congestion along Deptford Church Street which is concerning as it would result in an increase in particulates (PM) and Nitrogen dioxide (NO_2). While NO_2 baseline monitoring has been carried out in the area, no monitoring or modelling data has been provided and therefore further information is required about the impact of PM and NO_2 and how these impacts will be managed and mitigated.	The area has been assessed for construction/excavation activities and for construction traffic. The results are summarised in Section 4.10. 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 Lewisham, Section 48 response, October 2012	Officers have concerns about the effects of traffic, noise, vibration and dust on the school children.	An air quality and dust assessment has been undertaken for the Deptford Church Street site (see Section 4.5). This assessment has indicated no significant air quality effects in the vicinity of the Deptford Church Street site.
LB of Lewisham, Section 48 response, October 2012	In addition to this there will be a severe impact on the life of the school and potentially on teaching and learning. Both indoor and outdoor learning will be impacted by noise and air quality.	Both St Joseph's RC Primary School and new Tidemill Academy have been assessed as specific receptors in the local air quality and

Organisation	Comment	Response
		construction dust assessments. The results are provided in Section 4.5.
LB of Lewisham, Section 48 response, October 2012	The Deptford Church Street 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 impacts of the construction/excavation activities and the HGVs using the site are likely to result in an increase in particulate matter. The transport proposals are likely to cause significant congestion along Deptford Church Street which is concerning as it would result in an increase in particulates (PM) and nitrogen dioxide (NO_2). While NO_2 baseline monitoring has been carried out in the area, no monitoring or modelling data has been provided and therefore further information is required about the impact of PM and NO_2 and how these impacts 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 Lewisham, Section 48 response, October 2012	TTT have not yet demonstrated that the proposals will not result in a reduction in air quality. Approximately 11,000m^3 of excavated material is proposed in order to create a 48m deep shaft. In addition, TTT estimate that there will be an average of 9 additional HGV movements per day reaching a maximum of 32 additional HGV movements per day during the peak period which lasts for seven months. These will give rise to increases in particulate emissions and will need to be appropriately managed and mitigated.	An air quality and dust assessment has been undertaken for the Deptford Church Street site. This assessment has indicated no significant air quality effects in the vicinity of the Deptford Church Street site. Measures which are embedded in the project are set out in the *CoCP Part A*.
LB of Lewisham, Section 48	The section 48 material (Project description and environmental information report, page 218-219)	Measures which are embedded in the project are set out in the *CoCP*

Organisation	Comment	Response
response, October 2012	concludes that mitigation measures are not required, however a full assessment has not been undertaken and the effects are unknown. Dispersion modelling has not been undertaken and therefore the impact of particulates and nitrogen dioxide is unknown as is how the impacts will be managed and mitigated. It is premature to state that the adverse effects on air quality from construction are likely to be minor at the residential properties and school, and negligible at the church, commercial/office premises, playground and leisure centre (Project description and environmental information report, page 218-219).	*Part A*. A full assessment with dispersion modelling has been undertaken and the results of this assessment are detailed in Section 4.5. This assessment has indicated no significant air quality effects in the vicinity of the Deptford Church Street site.
LB of Lewisham, Section 48 response, October 2012	LBL do not have any information regarding the air quality model to be used - ADMS or equivalent should be used.	The dispersion model AAQuIRE has been used, which is an equivalent to ADMS. This is described in Volume 2.
LB of Lewisham, Section 48 response, October 2012	Information is required for both the construction and operational phases in relation to: • What are the impacts in terms of changes to concentrations of pollutants? • How have these impacts been assessed? • Who will be affected? • Can they be mitigated? • What are the proposed mitigation measures? • Have alternatives been considered and, if so, how does the data compare?	A full assessment with dispersion modelling has been undertaken for local air quality and odour and the results of this assessment for the Deptford Church Street site are set out in Section 4.5. The methodologies for these assessments are detailed in Volume 2. This assessment has indicated no significant air quality effects in the vicinity of the Deptford Church Street site. Measures which are embedded in the project are set out in the *CoCP Part A*. The *Environmental Statement* assesses the proposed scheme only.

Organisation	Comment	Response
LB of Lewisham, Section 48 response, October 2012	TTT should assess in the modelling the cumulative impacts at each location. The additional traffic movements, not just from each site but the total additional vehicle movements generated by the project as a whole, as well as factoring in the congestion created by changes to road layouts should be assessed in the modelling.	The effects of all Thames Tideway Tunnel project sites are considered within the assessment of each project site.

Baseline

4.3.2 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

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

4.3.4 Section 4.5 details the likely significant effects arising from the construction at the Deptford Church Street site. There are no other Thames Tideway Tunnel project sites which could elevate construction dust nuisance effects within the assessment area (see para. 4.3.5 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

4.3.5 The assessment area for the local air quality assessment during construction covers an area 600m by 500m centred on the Deptford Church Street 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 Deptford Church Street site are fully assessed. A distance of 200m is generally considered sufficient (Highways Agency, 2007)[2] to ensure that any significant effects are considered. The selected assessment area exceeds this considerably.

Construction assessment year

4.3.6 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, construction plant and construction dust) in which the development case (with the Thames Tideway Tunnel project) has been assessed against the base case (without the Thames

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

4.3.7 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.

Other developments

4.3.8 As indicated in the site development schedule (see Vol 23 Appendix N), there are two other new developments (mixed use developments at Giffin Street Regeneration Area and Creekside Village East) identified within the air quality assessment area. The Giffin Street Regeneration Area is being developed in phases, with part of it already complete (forming part of the baseline) while for other parts construction will continue until 2017. This means that the development is considered as both a baseline receptor and within the cumulative effects assessment (for those parts under construction in the peak construction year). With regard to the Creekside Village East development, this will still be under construction in the peak construction year and is therefore considered in the cumulative effects assessment.

Operation

4.3.9 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.

4.3.10 Section 4.6 details the likely significant effects arising from the operation at the Deptford Church Street site. There are no other Thames Tideway Tunnel project sites that 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

4.3.11 Odour dispersion modelling has been carried out over an area of 500m by 400m centred on the Deptford Church Street 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.

Operational assessment year

4.3.12 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.

Other developments

4.3.13 As indicated in the site development schedule (see Vol 23 Appendix N), there are two other new developments (mixed use developments at Giffin Street Regeneration Area and Creekside Village East) identified within the assessment area. As the Giffin Street Regeneration Area development is already partially complete this is considered as a baseline receptor. The Creekside Village East development is included as a receptor in the operational base case and has also been included in the dispersion

modelling as at 22 storeys it has the potential to affect dispersion. Due to the nature of the development there are no cumulative operational effects to assess.

Assumptions and limitations

Assumptions

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

Construction

4.3.15 The site specific assumptions in terms of model input are set out in Vol 23 Appendix B.1.

Operation

4.3.16 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. 4.2.13 - 4.2.15.

4.3.17 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 are assumed to be relatively low although there have been 25 complaints since 2007 in the surrounding area (see para.4.4.13). Seasonal spot measurements of hydrogen sulphide (H_2S) carried out in 2011/12 indicate that concentrations are typical of urban areas (Michigan Environmental Science Board, 2000)[3] but can be raised occasionally.

4.3.18 Following dispersion modelling, the maximum concentration predicted at any location was reported whether this was at a building where people could be exposed or on open land. As a worst case assumption, it was 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, separate volume of figures – Section 1), the impact would not be worse than that reported in Section 4.6.

Limitations

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

Construction

4.3.20 As there are no PM_{10} monitoring sites located within the vicinity of the Deptford Church Street site for which traffic data were available, it has not been possible to verify PM_{10} modelling results. The adjustment factor derived for nitrogen oxides (NO_X) (from a comparison of modelled and monitored NO_X data) has therefore been applied to the PM_{10} modelling results.

Operation

4.3.21 There are no 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 two continuous monitoring stations and six diffusion tubes which collect data pertinent to the Deptford Church Street site and associated construction traffic routes. The monitoring sites are operated by both LB of Lewisham and Royal Borough (RB) of Greenwich. The location of these is shown in Vol 23 Figure 4.4.1 (see separate volume of figures). Monitoring data for these sites for the period 2007-2011 are contained in Vol 23 Table 4.8.2 (NO_2 concentrations) and Vol 23 Table 4.8.3 (PM_{10} concentrations).

Vol 23 Table 4.8.2 Air quality – measured NO_2 concentrations

Monitoring site	Site type	Annual mean (µg/m^3)					Number of exceedances of hourly standard				
		2011	2010	2009	2008	2007	2011	2010	2009	2008	2007
Continuous monitoring sites											
Lewisham New Cross (LW2)	Roadside	**51**	**59**	**64**	**64**	**47**	0	0	9	5	0
Blackheath (GR7)	Roadside	**48**	**43**	**43**	**46**	**49**	1	0	0	0	5
Diffusion tube monitoring sites											
Blackheath Hill (GW33)	Roadside	**54**	**50**	**60**	**63**	**71**	NM				
Greenwich Church Street (GW42)	Roadside	**50**	**53**	**58**	**56**	**63**	NM				
Creek Road / McMillan Street (GW43)	Roadside	**57**	**41**	**59**	**58**	**62**	NM				
Greenwich South Street (GW48)	Roadside	**43**	**38**	**47**	**49**	**57**	NM				
Maidenstone Hill (GW58)	Roadside	**46**	**52**	**47**	**49**	**52**	NM				
Grinling Gibbons (SCH018)	Background	31	35	NM	NM	NM	NM				

Note: NM indicates not measured. Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m^3 for the annual mean and 200µg/m^3 for the hourly mean which can be exceeded 18 times per year. Codes in brackets represent monitoring site identifiers used in Vol 23 Figure 4.4.1 (see separate volume of figures).

Vol 23 Table 4.8.3 Air quality – measured PM_{10} concentrations

Monitoring site	Site type	Annual mean (µg/m^3)					Number of exceedances of daily standard				
		2011	2010	2009	2008	2007	2011	2010	2009	2008	2007
Lewisham New Cross (LW2)	Roadside	26	25	25	25	30	19	6	12	16	15
Blackheath (GR7)	Roadside	32	28	24	NM*	27	**41**	19	12	NM*	28

*Note: NM indicates not measured. * Data capture less than 75%. Emboldened figures indicate an exceedance of the objective which is 40µg/m^3 for the annual mean and 50µg/m^3 for the daily mean which can be exceeded 35 times per year. Codes in brackets represent monitoring site identifiers used in Vol 23 Figure 4.4.1 (see separate volume of figures).*

4.4.5 The monitoring data at these sites show that the annual mean NO_2 objective / limit value has been exceeded for all the roadside sites over the five years except for GW48 in 2010, in which the annual mean NO_2 objective / limit value was achieved. The hourly mean NO_2 objective was not exceeded in any of the five years at the two continuous monitoring sites.

4.4.6 The PM_{10} monitoring indicates that the annual mean objective / limit value (40µg/m^3) has not been exceeded at either monitoring location. The daily mean objective (no more than 35 exceedances of the daily standard) was not exceeded at the New Cross site (LW2) in any of the five years although an exceedance of the daily objective / limit value was measured at the Blackheath site (GR7) in 2011. The daily mean PM_{10} objective / limit value was not exceeded in the other four years at this site.

4.4.7 As a result of previous exceedances of air quality objectives, LB of Lewisham has declared five Air Quality Management Areas (AQMAs) for NO_2 and PM_{10}. The AQMAs consist of four large AQMAs to the north of the borough and a series of ribbon roads to the south. The Deptford Church Street site is located within an AQMA.

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 Deptford Church Street site. This monitoring comprises nine diffusion tubes based at the locations identified in Vol 23 Table 4.8.4. 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 two of the monitoring sites (DCSM1 and DCSM8) near the Deptford Church Street site; otherwise all the monitoring locations have single tubes.

Vol 23 Table 4.8.4 Air quality – additional monitoring locations

Monitoring site	Grid reference	Site type	2010 NO_2 annual mean (µg/m^3)
A200 Creek Road (DCSM1)	537221, 177679	Roadside	**69.1**
Deptford Green (DCSM2)	537381, 177850	Urban background	**45.5**

Monitoring site	Grid reference	Site type	2010 NO_2 annual mean ($\mu g/m^3$)
Hamilton Crescent (DCSM3)	537460, 178005	Urban background	**48.0**
Basevi Way (DCSM4)	537512, 177799	Urban background	**45.5**
A200 Creek Road (DCSM5)	537472, 177640	Roadside	**74.2**
Crossfield Street (DCSM6)	537259, 177419	Urban background	**42.9**
A2209 Deptford Church Street (DCSM7)	537393, 177268	Roadside	**57.8**
A2209 Deptford Church Street (DCSM8)	537389, 177024	Roadside	**67.3**
A2 New Cross Road (DCSM9)	537197, 176965	Kerbside	**80.0**

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

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

4.4.10 This monitoring has been used in conjunction with that carried out for Greenwich Pumping Station and existing RB of Greenwich and LB of Lewisham monitoring to define the baseline situation and also to provide input to model verification[iii].

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)[5]. 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 Deptford Church Street site are given in

4.4.12 Vol 23 Table 4.8.5 for 2010 (baseline year).

[iii] 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.

Vol 23 Table 4.8.5 Air quality – 2010 background pollutant concentrations

Pollutant*	2010
NO_2 (µg/m^3)	37.3
PM_{10} (µg/m^3)	21.3

** Annual mean for 1km grid square centred on 537500, 177500.*

Odour

4.4.13 The LB of Lewisham has not received any odour complaints for the local area over recent years (LB of Lewisham, 2012)[6]. Complaints in the Thames Water database were reviewed within an area of 500m radius of the zones identified for the proposed ventilation columns. Over the last five years (2007–2011), 25 complaints have been received relating to odour from the general sewerage system and local sewage pumping stations.

4.4.14 Data gathering for the EIA included spot measurements of hydrogen sulphide (H_2S) made near the site, the results of which are summarised in Vol 23 Table 4.8.6 and the monitoring locations shown in Vol 23 Figure 4.4.2 (see separate volume of figures). The highest concentrations, up to 30.5µg/m^3, were measured on 1 December 2011 during westerly wind conditions. These levels are typical of urban areas3 when a faint odour may be detectable on occasions (WHO, 2000)[7] [iv].

Vol 23 Table 4.8.6 Odour – measured H_2S concentrations

Location	Grid reference	Date	Time	H_2S concentration (µg/m^3)
Coffey Street (DCSS1)	537286, 177441	28/08/11	07:52:51	0.0
		28/08/11	07:53:24	0.0
		30/10/11	08:50:04	5.1
		30/10/11	08:50:33	4.7
		01/12/11	11:52:03	8.8
		01/12/11	11:53:25	8.2
		17/02/12	12:58:24	7.6
		17/02/12	12:59:33	6.9
		28/02/12	16:56:08	8.6
		28/02/12	16:57:31	7.7
		18/05/12	16:17:42	8.0

[iv] 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.

Location	Grid reference	Date	Time	H_2S concentration ($\mu g/m^3$)
		18/05/12	16:18:38	7.0
Coffey Street (DCSS2)	537367, 177448	28/08/11	07:54:43	0.0
		28/08/11	07:55:17	0.0
		30/10/11	08:51:17	0.0
		30/10/11	08:51:45	0.0
		01/12/11	11:58:20	30.5
		01/12/11	11:59:34	8.1
		17/02/12	13:01:28	6.9
		17/02/12	13:02:13	6.8
		28/02/12	16:58:59	7.3
		28/02/12	17:00:02	6.9
		18/05/12	16:20:44	6.2
		18/05/12	16:21:58	6.4
Crossfield Street (St Joseph's RC Primary School) (DCSS3)	537258, 177423	28/08/11	07:59:13	0.0
		28/08/11	07:59:42	0.0
		30/10/11	08:54:15	4.3
		30/10/11	08:54:46	0.0
		01/12/11	12:04:38	10.2
		01/12/11	12:05:40	8.2
		17/02/12	13:07:39	7.2
		17/02/12	13:08:47	7.2
		28/02/12	17:04:35	6.8
		28/02/12	17:05:41	6.6
		18/05/12	16:31:20	7.2
		18/05/12	16:32:28	6.8
Crossfield Street (DCSS4)	537378, 177368	28/08/11	07:56:54	0.0
		28/08/11	07:57:35	0.0
		30/10/11	08:52:45	0.0
		30/10/11	08:53:12	4.8
		01/12/11	12:01:33	9.6
		01/12/11	12:02:34	7.6
		17/02/12	13:03:55	7.9

Location	Grid reference	Date	Time	H_2S concentration ($\mu g/m^3$)
		17/02/12	13:05:13	9.6
		28/02/12	17:01:28	7.0
		28/02/12	17:02:31	6.9
		18/05/12	16:23:35	6.2
		18/05/12	16:24:39	8.3
Meteorological conditions: 28/08/11 SW wind up to 2m/s, partially cloudy, rain on previous day. 30/10/11 SW wind at 0.5m/s, cloudy, last rain on 27/10/11. 01/12/11 W wind up to 1.8m/s, partially cloudy. 17/02/12 W wind up to 2.5m/s, cloudy. 18/05/12 NW wind, average speed 1 m/s				

Receptors

4.4.15 As set out in Section 4.1 and Vol 2 Section 4, the air quality assessment involves the selection of appropriate receptors, which are shown in Vol 23 Figure 4.4.3 (see separate volume of figures) and the table below (Vol 23 Table 4.8.7) for the Deptford Church Street site. All of these receptors are relevant, albeit with different levels of sensitivity to each of the elements of the air quality assessment. The sensitivity of identified receptors has been determined using the criteria detailed in Vol 2 Section 4.

4.4.16 It is noted that Vol 23 Table 4.8.7 includes a receptor associated with the proposed Creekside Village East development for consideration in the odour assessment.

Vol 23 Table 4.8.7 Air quality and odour – receptors

Receptors (relating to all identified emissions sources)	Approximate distance of modelled receptor from site boundary 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 - Browne House (DCSR8)	27m southeast	High (exposure relevant to annual mean, daily mean and hourly mean standards).	Medium	High
Residential - Berthon Street (DCSR5)	13m northeast	High (exposure relevant to annual mean, daily mean and hourly mean standards).	Medium	High
Residential - Congers House (DCSR7)	31m east	High (exposure relevant to annual mean, daily mean and hourly mean standards).	Medium	High
Residential – Creekside Village East (DCSR13)*	220m northeast	Not applicable as the development will still be under construction in Site Year 1 of construction		High
Residential/Educational - Giffin Street Regeneration Area (DCSR10)	42m southwest	High (exposure relevant to annual mean, daily mean and hourly mean standards).	Medium	High
Educational - St Joseph's RC Primary School playground (DCSR12)	10m west	High (exposure relevant to annual mean, daily mean and hourly mean standards).	Medium	High
Educational - St Joseph's RC Primary School building (DCSR3)	20m west	Medium (exposure relevant for hourly NO_2 only).	Medium	High
Educational - Tidemill Primary	135m south	High (exposure relevant to annual	Medium	High

Receptors (relating to all identified emissions sources)	Approximate distance of modelled receptor from site boundary and direction from site	Receptor sensitivity		
		Air quality (construction traffic and construction plant)	Construction dust (on-site demolition and construction processes)	Odour (ventilation column)
School (DCSR11)		mean, daily mean and hourly mean standards).		
Recreational - Sue Godfrey Local Nature Reserve (DCSR6)	7m east	Medium (exposure relevant for hourly NO_2 only).	Medium	Medium
Recreational - Wavelengths Library (DCSR9)	45m south	Medium (exposure is relevant for the hourly mean standard only).	Medium	Medium
Recreational - Playground (DCSR1)	85m northwest	Medium (exposure is relevant for the hourly mean standard only).	Medium	Medium
Places of Worship - St Paul's Church (DCSR2)	30m north	Medium (exposure is relevant for the hourly mean standard only).	Medium	Medium
Commercial/Retail - Berhams Plumbers Merchant (DCSR4)	10m south	Low (exposure not relevant for the local air quality objectives).	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)[8] 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 European Union (EU). These standards are defined through a series of EU 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) (Defra, 2009)[9]. Background pollutant concentrations for Site Year 1 of construction (peak construction year) used in the modelling are shown in Vol 23 Table 4.8.8.

4.4.20 The background NO_2 concentration has been derived from the 2010 annual mean measured at the background location at LB of Lewisham's Grinling Gibbons School (SCH018) while the background PM_{10} concentration has been taken from the Defra mapped background data5. The Defra mapping has been used for the PM_{10} background, as there are no suitable PM_{10} monitors within the assessment area.

Vol 23 Table 4.8.8 Air quality – annual mean background pollutant concentrations

Pollutant	Baseline (2010)	Peak construction year (Site Year 1 of construction)
NO_2 (µg/m^3)*	35.3	27.8
PM_{10} (µg/m^3)**	21.1	19.4

*Note: * Taken from monitoring site Grinling Gibbons (SCH018). ** Taken from Defra mapped 1km grid square centred on 537500, 177500. Adjusted to ensure local A roads are not double counted.*

Operational base case

4.4.21 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.

4.4.22 As described in Section 4.3, the base case in Site Year 1 of construction takes into account the development, Creekside Village East, including it as

a receptor location in the odour assessment. This is included in the receptor list provided in Vol 23 Table 4.8.7.

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 the significance of effects at specified receptors (listed in Vol 23 Table 4.8.7).

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 Deptford Church Street site in line with the Defra guidance LAQM.TG(09)9. This checks the model performance against measured concentrations, using twelve diffusion tube sites established for this and the Greenwich Pumping Station site assessments and two run by RB of Greenwich (DCSM1, DCSM5-9 and GPSM1-4 – see Vol 23 Table 4.8.4 and GWS43, GWS48 – see Vol 23 Table 4.8.2). Further details regarding the verification process are included in Vol 23 Appendix B.1. The model adjustment factor derived from the verification process was applied to NO_2 and PM_{10} model results.

4.5.4 The model inputs for the local air quality assessment for the Deptford Church Street site are also detailed in Vol 23 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 construction plant.

NO_2 concentrations

4.5.5 Predicted annual mean NO_2 concentrations for the modelled scenarios are shown in Vol 23 Table 4.8.9. 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 criteria are inferred from the annual mean concentration. Additionally, contour plots are provided (Vol 23 Figure 4.5.1 to Vol 23 Figure 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 23 Figure 4.5.4 (see separate volume of figures).

4.5.6 The modelled concentrations in Vol 23 Table 4.8.9 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.

4.5.7 Exceedances of the annual mean criterion (40µg/m^3) are predicted at all receptors in the baseline scenario and six receptors in the base and development cases. In line with LAQM.TG(09)9, as all modelled concentrations in the peak construction year were below 60µg/m^3, exceedances of the hourly NO_2 air quality objective / limit value are considered unlikely in both the base case and development case.

Vol 23 Table 4.8.9 Air quality – predicted annual mean NO_2 concentrations

Receptor	Predicted annual mean NO_2 concentration (µg/m^3)			Change between base and dev cases (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					
Browne House residential (DCSR8)	**65.7**	**52.0**	**52.1**	0.2	Negligible
Berthon Street residential (DCSR5)	**63.4**	**50.3**	**50.4**	0.2	Negligible
Congers House residential (DCSR7)	**55.9**	**43.8**	**44.1**	0.3	Negligible
Giffin Street Regeneration Area residential/ educational (DCSR10)	**46.4**	36.5	36.9	0.5	Small
St Joseph's RC Primary School building (DCSR3)	**46.2**	36.4	37.0	0.7	Small

Receptor	Predicted annual mean NO_2 concentration ($\mu g/m^3$)			Change between base and dev cases ($\mu g/m^3$)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Tidemill Primary School (DCSR11)	**53.1**	**41.6**	**41.6**	0.1	Negligible
Receptors where the annual mean objective / limit value does not apply					
St Joseph's RC Primary School playground (DCSR12)	**46.8**	36.9	38.0	1.1	Small
Sue Godfrey Local Nature Reserve (DCSR6)	**65.2**	**51.4**	**51.7**	0.4	Small
Wavelengths Library (DCSR9)	**65.4**	**51.9**	**52.0**	0.2	Negligible
Playground (DCSR1)	**50.0**	39.6	39.8	0.1	Negligible
St Paul's Church (DCSR2)	**47.6**	37.7	37.9	0.3	Negligible
Berhams Plumbers Merchant (DCSR4)	**48.6**	38.1	39.5	1.4	Small

*Note: Emboldened figures indicate an exceedance of the criteria which is 40µg/m^3 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 predicted increase in annual mean concentration as a result of the construction works at the Deptford Church Street site is 1.4µg/m^3, which is predicted at Berhams Plumbers Merchant (DCSR4). However, the annual mean objective / limit value (40µg/m^3) does not apply here. The largest increase at a receptor of relevant exposure to the annual mean concentration is 0.7µg/m^3 at St Joseph's RC Primary School building (DCSR3). 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 St Joseph's RC Primary School building (DCSR3) and at residential properties in Giffin Street Regeneration Area (DCSR10), which have a high sensitivity to local air quality, is **minor**

adverse (according to the criteria detailed in Vol 2 Section 4). All other receptors are predicted to 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 23 Table 4.8.10. This table details the forecast PM_{10} concentrations at specific sensitive receptors. Additionally, contour plots are provided (Vol 23 Figure 4.5.5 to Vol 23 Figure 4.5.7, 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 annual mean PM_{10} concentrations between the base and development cases (in the peak construction year) is also presented at Vol 23 Figure 4.5.8 (see separate volume of figures).

4.5.11 The modelled concentrations in Vol 23 Table 4.8.10 show that annual mean concentrations of PM_{10} are predicted to achieve the annual mean criteria (40µg/m^3) and 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 predicted results for the development case show very small increases over the base case at four modelled receptors due to construction activities at the Deptford Church Street site.

Vol 23 Table 4.8.10 Air quality – predicted annual mean PM_{10} concentrations

Receptor	Predicted annual mean PM_{10} concentration (µg/m^3)			Change between base and dev cases (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					
Browne House residential (DCSR8)	26.8	24.1	24.1	0.0	Negligible
Berthon Street residential (DCSR5)	26.7	24.0	24.0	0.0	Negligible
Congers House residential (DCSR7)	24.8	22.4	22.4	0.0	Negligible
Giffin Street Regeneration Area residential/ educational (DCSR10)	22.9	20.8	20.9	0.1	Negligible

Receptor	Predicted annual mean PM_{10} concentration ($\mu g/m^3$)			Change between base and dev cases ($\mu g/m^3$)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
St Joseph's RC Primary School building (DCSR3)	22.8	20.7	20.8	0.1	Negligible
Tidemill Primary School (DCSR11)	24.0	21.7	21.7	0.0	Negligible
Receptors where the annual mean objective / limit value does not apply					
St Joseph's RC Primary School playground (DCSR12)	23.0	20.8	21.0	0.2	Negligible
Sue Godfrey Local Nature Reserve (DCSR6)	27.3	24.6	24.6	0.0	Negligible
Wavelengths Library (DCSR9)	26.6	23.9	23.9	0.0	Negligible
Playground (DCSR1)	23.5	21.2	21.2	0.0	Negligible
St Paul's Church (DCSR2)	23.1	20.9	20.9	0.0	Negligible
Berhams Plumbers Merchant (DCSR4)	23.3	21.1	21.3	0.2	Negligible

*Note: 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 largest predicted increase in the annual mean concentration as a result of construction at the Deptford Church Street site is 0.2µg/m^3, predicted at Berhams Plumbers Merchants (DCSR4) and St Joseph's RC Primary School playground (DCSR12). The largest increase at a receptor of relevant exposure to the annual mean concentration is 0.1µg/m^3 at St Joseph's RC Primary School building (DCSR3) and Giffin Street Regeneration Area (DCSR10). This change is described as negligible according to the criteria detailed in Vol 2 Section 4.

4.5.13 With no exceedances of the annual mean PM_{10} standard (40µg/m^3), the significance of the effects is **negligible** at all receptors**.**

4.5.14 With regard to the daily mean PM_{10} concentrations, Vol 23 Table 4.8.11 shows the predicted number exceedances of the daily PM_{10} standard (50µg/m^3) for each modelled scenario. The objective / limit value allows no more than 35 exceedances in a year.

4.5.15 The results in Vol 23 Table 4.8.11 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. This decrease is due to predicted reductions in background concentrations and improved vehicle engine technology. The predicted results for the development case show no increases in the number of exceedances of the daily PM_{10} standard (50µg/m^3), compared with the base case, due to construction works at the Deptford Church Street site.

4.5.16 With no exceedances of the of the daily PM_{10} objective / limit value in the development case, the significance of the effects would be **negligible** at all sensitive receptors.

Vol 23 Table 4.8.11 Air quality – predicted exceedances of the daily PM_{10} standard

Receptor	Predicted number of exceedances of the daily PM_{10} standard			Change between base and dev cases (days)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Receptors where the objective / limit value does apply					
Browne House residential (DCSR8)	17	10	10	0	Negligible
Berthon Street residential (DCSR5)	17	10	10	0	Negligible
Congers House residential (DCSR7)	12	7	7	0	Negligible
Giffin Street Regeneration Area residential/ educational (DCSR10)	8	4	5	0	Negligible
St Joseph's RC Primary School building (DCSR3)	8	4	5	0	Negligible

Receptor	Predicted number of exceedances of the daily PM_{10} standard			Change between base and dev cases (days)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Tidemill Primary School (DCSR11)	10	6	6	0	Negligible
Receptors where the objective / limit value does not apply					
St Joseph's RC Primary School playground (DCSR12)	8	4	5	0	Negligible
Sue Godfrey Local Nature Reserve (DCSR6)	18	11	11	0	Negligible
Wavelengths Library (DCSR9)	17	10	10	0	Negligible
Playground (DCSR1)	9	5	5	0	Negligible
St Paul's Church (DCSR2)	8	5	5	0	Negligible
Berhams Plumbers Merchant (DCSR4)	9	5	5	0	Negligible

Note: Changes at each receptor have been rounded to the nearest whole number.
** Denotes receptor that is altered or constructed after the baseline year.*

Sensitivity test for programme delay

4.5.17 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 receptors. Based on the development schedule (Vol 23 Appendix N), it is possible that as a result of the one year delay, more of the Giffin Street Regeneration Area and part of the Creekside Village East development 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 (or lesser) effects to those that have already been identified.

Construction dust

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

4.5.19 Dust sensitive receptors have been identified in the vicinity of the Deptford Church Street site in accordance with the criteria in Vol 2 Section 4, as described in Vol 23 Table 4.8.7. A summary of the approximate numbers of receptors in distance bands from the Deptford Church Street site is detailed in Vol 23 Table 4.8.12.

Vol 23 Table 4.8.12 Air quality – numbers of dust sensitive receptors

Buffer distance (m)	Number of receptors*	Receptor type
<20	10-100	Residential, St Joseph's RC Primary School, offices, open space, commercial
20-50	10-100	St Joseph's RC Primary School, offices, residential, open space, church, swimming pool, library
50-100	100-500	Residential, open space, church, swimming pool
100-350	More than 500	Residential, open space,

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

4.5.20 In line with the Institute of Air Quality Management (IAQM) guidance (IAQM, 2012)[10], the site has been categorised using the criteria given in Vol 2 Section 4 to assess 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.

4.5.21 The demolition for the Deptford Church Street site is classified as a 'small' dust emission class. This classification is based on the small volume of the demolition materials, which would be less than 20,000m^3. As the nearest receptor is within 20m from the construction site, this makes the risk category for demolition activities medium risk.

4.5.22 The earthworks have been assessed to be a 'medium' dust emission class as the size of the construction site is greater than 10,000m^2 but the total material to be moved is between 20,000 and 100,000 tonnes. With the nearest receptor within 20m, the site is assessed to be high risk for earthworks.

4.5.23 The construction proposed for the Deptford Church Street site has a 'medium' dust emission class. This classification is based on the small size of the building volumes. The risk category for construction activities is therefore assessed to be high risk due to the proximity of the closest receptors.

4.5.24 There would be 50-100m of unpaved haul roads on site, and the number of construction lorries would be between 25-100 per day, 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.

4.5.25 The risk categories for the four activities are summarised in Vol 23 Table 4.8.13. This summary of the effects of construction does not take into account the measures outlined in the *CoCP* Part A (Section 7).

Vol 23 Table 4.8.13 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

4.5.26 On this basis, the development at the Deptford Church Street site is classified as a high risk site overall.

4.5.27 The area has been defined as 'high' sensitivity due to the sensitivity of the receptors (as identified in Vol 23 Table 4.8.7), the duration of the works and the presence of residential receptors within 20m from the site.

4.5.28 With regard to the significance of effects, a high risk site with a high sensitivity of the area would result in a moderate 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 20m of the site boundary (in accordance with IAQM guidance[10]). The significance of construction dust effects at receptors greater than 20m 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 23 Table 4.8.14.

Vol 23 Table 4.8.14 Air quality – significance of construction dust effects

Receptor	Significance of effect
Residential, Browne House residential (DCSR8)	Negligible
Residential, Berthon Street residential (DCSR5)	Minor adverse
Residential, Congers House residential (DCSR7)	Negligible
Giffin Street Regeneration Area residential/ educational (DCSR10)	Negligible
St Joseph's RC Primary School building (DCSR3)	Minor adverse

Receptor	Significance of effect
St Joseph's RC Primary School playground (DCSR12)	Minor adverse
Tidemill Primary School (DCSR11)	Negligible
Sue Godfrey Local Nature Reserve (DCSR6)	Minor adverse
Wavelengths Library (DCSR9)	Negligible
Playground (DCSR1)	Negligible
St Paul's Church (DCSR2)	Negligible
Berhams Plumbers Merchant (DCSR4)	Minor adverse

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

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 23 Table 4.8.15 shows the predicted maximum ground level odour concentrations at the Deptford Church Street 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 1.5ou$_E$/m^3. Achieving the 98th percentile is considered to prevent nuisance and protect amenity. 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 Environment Agency benchmark permits 175 hours above 1.5ou$_E$/m^3. The table also identifies the magnitude of the identified impacts in accordance with the criteria detailed in Vol 2 Section 4.

Vol 23 Table 4.8.15 Odour – impacts and magnitude – operation

Year	Maximum at ground level locations		Impact magnitude and justification
Typical	98th percentile (ou$_E$/m^3)	0	Negligible 98th percentile concentration is less than 1ou$_E$/m^3
	No. of hours > 1.5ou$_E$/m^3	14	

4.6.2 In Vol 23 Table 4.8.15 above, the 98th percentile is shown as zero as air would be released from the ventilation columns 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 within 10m of the ventilation columns and are predicted to be above $1.5ou_E/m^3$ for 14 hours in a typical year. The number of hours exceeding $1.5ou_E/m^3$ reduces rapidly with distance from the columns such that odour would be above $1.5ou_E/m^3$ for one or two hours in a year between 20m and 90m from the ventilation columns. On an hourly average basis a very infrequent odour may occur at the retail/commercial properties on Crossfield Street to the south, the Wavelength Leisure Centre, in Deptford Church Street and in St Paul's Gardens. The building with the most frequent odour would be the commercial premises in Crossfield Street to the south of the columns with ten hours in a typical year. With a frequent use year (ie, a more rainy year than average), the concentrations would be similar to those in the typical use year.

4.6.4 With regard to the significance of effects, given that the predicted odour concentrations at all locations would not exceed the 98th percentile benchmark of $1.5ou_E/m^3$, 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, two developments, Giffin Street Regeneration Area and Creekside Village East, would be under construction during the peak construction year at the Deptford Church Street site. It is expected that construction activities at these sites could elevate dust, NO_2 and PM_{10} concentrations near that site and could also have an effect near the Deptford Church Street site. However, this effect is likely to be small and not affect the significance of the impact due to construction activities at the Deptford Church Street site. 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 Giffin Street Regeneration Area and some of the Creekside Village East development 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 air quality 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. 4.2.15) 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 Deptford Church Street 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 23 Table 4.10.1 Air quality – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential - Browne House (DCSR8)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Residential - Berthon Street (DCSR5)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Residential - Congers House (DCSR7)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Residential/Educational - Giffin Street Regeneration Area (DCSR10)	Local air quality – effects from construction road traffic and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Negligible	None	Negligible
Educational - St Joseph's RC Primary School playground (DCSR12)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Educational - St Joseph's RC Primary School building (DCSR3)	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

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Educational - Tidemill Primary School (DCSR11)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Recreational - Sue Godfrey Local Nature Reserve (DCSR6)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Recreational - Wavelengths Library (DCSR9)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Recreational - Playground (DCSR1)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Places of Worship - St Paul's Church (DCSR2)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Commercial/Retail - Berhams Plumbers Merchant (DCSR4)	Local air quality – effects from construction road traffic and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse

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

Vol 23 Table 4.10.2 Odour – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential, Browne House (DCSR8)	Odour	Negligible	None	Negligible
Residential, Berthon Street (DCSR5)		Negligible	None	Negligible
Residential, Congers House (DCSR7)		Negligible	None	Negligible
Residential/Educational, Giffin Street Regeneration Area (DCSR10)		Negligible	None	Negligible
Residential – Creekside Village East (DCSR13)*		Negligible	None	Negligible
Educational - St Joseph's RC Primary School playground (DCSR12)		Negligible	None	Negligible
Educational, St Joseph's RC Primary School building (DCSR3)		Negligible	None	Negligible
Educational, Tidemill Primary School (DCSR11)		Negligible	None	Negligible
Recreational, Sue Godfrey Local Nature Reserve (DCSR6)		Negligible	None	Negligible
Recreational, Wavelengths Library (DCSR9)		Negligible	None	Negligible
Recreational, Playground (DCSR1)		Negligible	None	Negligible
Places of Worship, St Paul's Church (DCSR2)		Negligible	None	Negligible
Commercial/Retail, Berhams Plumbers Merchant (DCSR4)		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, http://laqm.defra.gov.uk/maps/maps2010.html. Accessed June 2012.

[6] LB of Lewisham, Personal Communication, July 2012.

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

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

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

[10] 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: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 5: Ecology - aquatic

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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 23: Deptford Church Street 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 Deptford Church Street 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 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 this location.

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 Deptford Storm Relief 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 project, 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 effects assessment. This section assesses the localised effects at a site-specific level for the Deptford Storm Relief CSO site.

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[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 23 Deptford Church Street 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 the elements of the

operation of the proposed development of relevance to aquatic ecology are set out below.

Operation

5.2.2 The Deptford Storm Relief CSO currently discharges into the tidal Thames at Borthwick Wharf, near the mouth of the Deptford Creek, in the Royal Borough (RB) of Greenwich. Discharges from the CSO would be intercepted at Deptford Church Street, in the London Borough (LB) of Lewisham as part of the proposed development. Based on the base case (which includes permitted sewage treatment works upgrades, and the Lee Tunnel scheme, as well as projected population increases which have been modelled for 2021) discharges during the Typical Year[i] from this CSO are anticipated to be 1,980,000m^3 per annum over a total of 39 discharge events (or spills) by 2021. The discharge is projected to reduce to 163,000m^3 from a total of four discharge events once the proposed development, including the Thames Tideway Tunnel project, is operational. This represents an approximately 92% 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*. The *Scoping Report* was prepared before the Deptford Church Street site was identified as a potential site. The scope for aquatic ecology assessment for this site has therefore drawn on other scoping responses received, comments received through stakeholder meetings (including the recurrent Thames Tideway Tunnel project biodiversity working group that has been attended by stakeholders including the LB of Lewisham), stakeholder responses to the consultation and from professional judgment.

5.3.2 No specific comments have been made concerning the Deptford Church Street site of relevance to aquatic ecology.

Baseline

5.3.3 The baseline methodology follows the methodology described in Vol 2 Section 5. There are no site-specific variations for identifying the baseline conditions for this site.

5.3.4 The assessment is based on desk study and survey data. For habitats, mammals, fish, invertebrates and algae, desk study data have been obtained for the whole of the tidal Thames. The data sets for fish, invertebrates and algae are based on fixed sampling locations at intervals through the tidal Thames. Sites as close to Deptford Church Street as

[i] The 'Typical Year' represents the most 'typical' 12 month period of rainfall observed between 1970 and 2011 and covers the period from October 1979 to September 1980.

possible have been selected. Details of the background and data sets are provided in Vol 2 Section 5.

5.3.5 Surveys for fish and invertebrates have been undertaken during October 2010 at Borthwick Wharf/ Deptford Storm Relief CSO, with repeat surveys for invertebrates in May 2011. During these surveys, the intertidal habitats present have been recorded. As part of the project wide assessment, 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 is at Bermondsey Wall East, approximately 5km upstream of the Deptford Storm Relief CSO. Surveys for algae have been undertaken at King Edward Memorial Park Foreshore located approximately 4km upstream of Deptford Storm Relief CSO in May 2012. The survey comprised sampling of algae along a vertical transect of the river wall.

Operation

5.3.6 The assessment methodology for the operational phase follows that described in Vol 2 Section 5. The assessment area is the zone which lies within a 100m radius of the existing CSO discharge point. 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 opening 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.

5.3.7 Section 5.6 details the likely significant effects arising from the operation at the Deptford Church Street site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on aquatic ecology receptors within the operational assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment. 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 Section 5.

5.3.8 No schemes from the site development schedule (Vol 23 Appendix N) are considered relevant to the aquatic ecology base case. The development at Convoys Wharf would be complete and operational by the first year of operation, and it would include a wharf with associated vessel moorings and a jetty. It lies approximately 400m upstream of the CSO discharge point at Borthwick Wharf. It is not considered that this would alter the aquatic ecology baseline for the Deptford Church Street 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 those effects are not considered to extend to the area around the Deptford Storm Relief CSO discharge. 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.

5.3.9 The Heathside and Lethbridge Estate development is identified as the only scheme in the site development schedule (see Vol 23 Appendix N) that could lead to a cumulative impact at Deptford Church Street. It is not considered that this development would alter the aquatic ecology baseline for the Deptford Church Street site because it is in-land and there would be no impacts on water quality from the this development. Therefore no cumulative impact assessment has been undertaken.

5.3.10 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

5.3.11 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 5. Assumptions and limitations specific to this site are outlined below.

Assumptions

5.3.12 There are no assumptions specific to the assessment of Deptford Church Street.

Limitations

5.3.13 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 (i.e., with a basis in law) or non-statutory (i.e., 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 Section 5.

5.4.4 The tidal Thames is part of the proposed Thames Estuary South East 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 (i.e. Sites of Special Scientific Interest (SSSI) or Local Nature Reserves (LNR)) designated for aquatic ecology within the assessment area.

5.4.6 The Deptford Storm Relief CSO discharges directly into one non statutory site, the 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, is adopted by all boroughs which border the River Thames. It recognises the range and quality of estuarine habitats including mud flat, shingle beach, reedbeds and the river channel. The SINC citation notes that over 120 species of fish have been recorded in the tidal Thames, 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, undated)[3]. 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*. The RB of Greenwich (where the CSO discharge point is located) also has a *HAP* for the tidal Thames (Greenwich Council, 2010)[4].

5.4.8 The river is divided into three zones within the tidal Thames *HAP*; freshwater, brackish and marine, shown on Vol 3 Figure 5.4.1 (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 Section 5.

5.4.9 The Deptford Storm Relief CSO lies within the brackish zone, 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

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

fluctuating tidal conditions, which means that flora and fauna have to be able to tolerate wide variations in their physical environment.

5.4.10 During the survey of habitats at the Deptford Storm Relief CSO discharge location at Borthwick Wharf the intertidal habitat was recorded as consisting of a heavily scoured bed of pebbles and cobbles. The CSO discharge point is also located within an area of the UK *BAP* priority habitat 'mudflats' (Natural England, undated)[5].

5.4.11 A summary of habitat types present and other features of interest are presented in Vol 23 Table 5.4.1.

Vol 23 Table 5.4.1 Aquatic ecology – principal habitat, substrate and other features of interest at Deptford Storm Relief CSO at Borthwick Wharf

UK *BAP* target habitats present and features of interest	Substrate present in intertidal zone (approximate cover)	Substrate present in subtidal samples
Gravel foreshore Sublittoral sand and gravels River wall	Pebbles (65%) Cobbles (35%)	Armoured bottom, pebbles and cobbles

Evaluation of designations and habitats for Deptford Storm Relief CSO

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 seal species (grey seal (*Halichoerus grypus*) and common seal (*Phoca vitulina*)) migrate through the tidal Thames. One record of a dolphin species, and two records of seal (one grey, one unidentified) were made within 300m of the Deptford Storm Relief CSO discharge location, and nine records (including seven common seal) were received for the river 500m to 1km downstream.

Evaluation of marine mammals for Deptford Storm Relief CSO

5.4.14 The CSO discharge site is considered to be of low-medium (local) value for marine mammals given the small number of records of porpoise, dolphin and seal. 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 Section 5.

Baseline surveys

5.4.16 A single day survey was undertaken at Borthwick Wharf (Deptford Storm Relief CSO) during October 2010. Full details of the methodology and rationale for the timing of surveys are presented in Vol 2 Section 5. The area covered by the survey is illustrated in Vol 23 Figure 5.4.1 (see separate volume of figures).

5.4.17 Fish are routinely categorised into 'guilds' according to their tolerance to salinity and habitat preference (Elliot and Taylor, 1989[6], Elliot and Hemingway, 2002[7]). The species which occur in the tidal Thames can be divided into the following four guilds:

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

b. Estuarine resident – species which remain in the estuary 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 This site ranked in the middle of the 15 sampling locations along the tidal Thames. The lowest catch (at Albert Embankment Foreshore) was of 19 individuals. Six species were identified at Borthwick Wharf, the majority being smelt and common goby (*Pomatoschistus microps*). The range of species recorded and the number of individuals is presented in Vol 23 Table 5.4.2.

Vol 23 Table 5.4.2 Aquatic ecology – results of autumn 2010 fish surveys at Borthwick Wharf (Deptford Storm Relief CSO)

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*	1	Estuarine resident

Common name	Scientific name	Number of individuals	Guild
	labrax		

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).

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 site locations are presented in Vol 2 Figure 5.4.4 (see separate volume of figures). The nearest sampling site to Deptford Church Street CSO is at Bermondsey Wall East, approximately 5km upstream. The findings are however of some relevance to the Deptford Church Street CSO site because it gives context to the assemblage of fish that may be expected to be found in this broad reach of the river. 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 Section 5.

5.4.22 The data from the juvenile fish surveys at the Bermondsey Wall East are shown in Vol 23 Table 5.4.3.

Vol 23 Table 5.4.3 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

Common name	Scientific name	Number of individuals					
		Survey 1 May	2 late May	3 June	4 July	5 Aug	6 Sept
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.

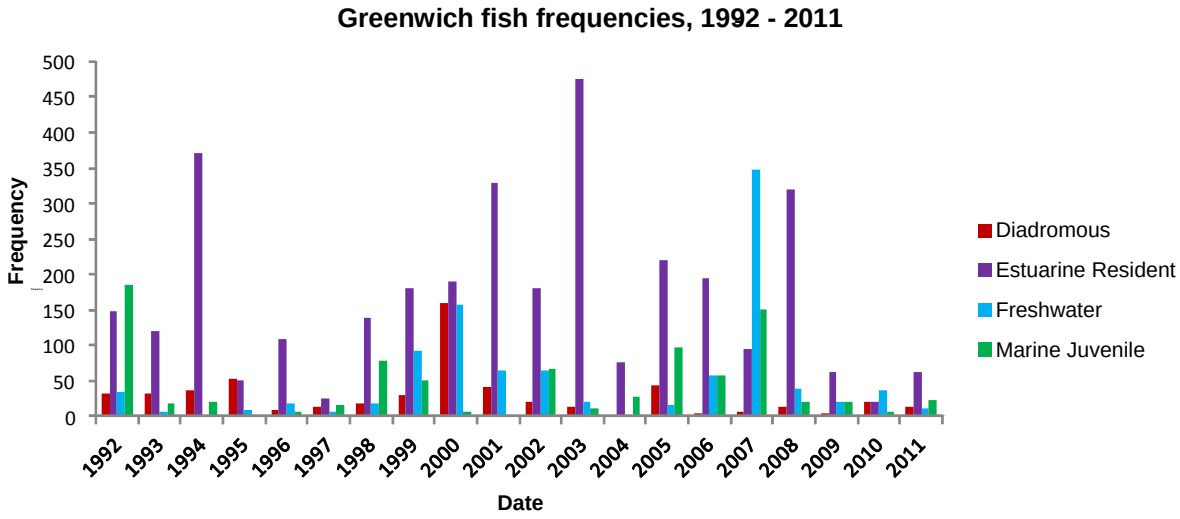
Environment Agency background data

5.4.24 The EA carry out annual surveys of fish within the tidal Thames using a variety of methods including trawling and seine netting, with data available from 1992-2011. The nearest sampling site to the Deptford Storm Relief CSO discharge is Greenwich, located 0.4km downstream of the confluence of the tidal Thames with the Deptford Creek, where EA surveys have been carried out every year from 1992 to 2011.

5.4.25 Results from EA Greenwich sampling point show fairly steady catches in trawls but some indication of increasing seine-net catches in recent years (Vol 23 Plate 5.4.1). Catches are dominated by estuarine resident fish 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 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 23 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 study 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 5).

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 Section 5 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 Environment Agency'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 for 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 'life stage 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 species/life stage 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 Deptford Church Street

5.4.31 The Deptford Church Street 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: one during October 2010 and one during May 2011. The area covered by the survey is illustrated in Vol 23 Figure 5.4.1 (see separate volume of figures). Further details of these methods can be found in Vol 2 Section 5.

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. The invertebrates collected during these surveys are presented in Vol 23 Table 5.4.4 and Vol 23 Table 5.4.6.

5.4.35 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 23 Table 5.4.4 Aquatic ecology – invertebrate fauna sampled at Borthwick Wharf (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	-	2	0	0	0	3	145	1500	2	0
Erpobdella testacea	5	0	0	0	0	0	1	12	0	0
Crangon crangon	-	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	3	1	0	0	0	0	0	3	0	0

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**
volutator										
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 23 Table 5.4.5 Aquatic ecology – invertebrate fauna sampled at Borthwick Wharf (Deptford Storm Relief CSO) May 2011

Taxa	CCI score	No. of individuals - subtidal samples		No. of individuals - intertidal samples		
Sample numbers		**Air lift 1**	**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 Tideway, 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 to 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 considerably more diverse and abundant invertebrate fauna than intertidal samples (seven and ten 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 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 discharge within the area and poor background water quality.

5.4.39 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* and *Crangon crangon* (shrimp, typical of estuarine and brackish conditions).

5.4.40 The only species of high nature conservation importance was the mudshrimp *A. lacustre* (CCI 8), a RDB species recorded in October 2010 but not in May 2011, which was present in subtidal samples at the site EA data have however, 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.

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

Environment Agency (EA) background data

5.4.42 The EA sampling site at Greenwich, 0.4km downstream, 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.

5.4.43 A total of 35 taxa were recorded at Greenwich over the seven year period in which samples were collected. The taxa Oligochaeta, 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*.

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

5.4.45 It is believed that this species arrived in English waters via ballast water from ships. It lives in fresh and brackish waters and 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 tidal Thames.

5.4.46 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

5.4.47 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/ Deptford Storm Relief CSO are indicative of polluted conditions because they are able to tolerate the low DO conditions and multiply rapidly in the enriched sediments.

5.4.48 The analysis is described in further detail in Vol 3 Section 14.4. The following summary is relevant to the brackish zone of the tidal Thames in which the Deptford Storm Relief CSO site is located.

5.4.49 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.

5.4.50 Redundancy analysis[iii] (RDA) 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.

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

Evaluation of invertebrate community for Deptford Storm Relief CSO

5.4.51 Deptford Storm Relief CSO is considered to be of medium (borough) importance due to the dominance of the invertebrate community by a limited range of pollution tolerant species. Only a single species of conservation importance (*A. lacustre*) was recorded, and it is ubiquitous within the tidal Thames.

Algae

5.4.52 Algae occur 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 both salinity, habitat and environmental conditions. 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

5.4.53 A single day survey was undertaken in May 2012 at King Edward Memorial Park foreshore, located approximately 4km upstream of the Deptford Storm Relief CSO. 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 23 Table 5.4.6.

Vol 23 Table 5.4.6 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

Species	Survey Observations	Species presence within the Thames Estuary
		occurs on the upper littoral levels on sea walls. Widespread in the Tidal Thames

Natural History Museum background data

5.4.54 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, the closest to the CSO discharge point which is approximately 800m downstream. The records are shown in Vol 23 Table 5.4.7.

Vol 23 Table 5.4.7 Aquatic ecology – marine algae sampled at Deptford 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.
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 on sea walls. Common in tidal Thames.
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 walls and floating structures just above the water line. Widespread in the tidal Thames.
Gayralia oxysperma	Upper littoral levels on sea-walls in the middle reaches of the estuary. Recorded only since 1975.

Water quality and algal communities

5.4.55 Algae depend on the nutrients nitrate and phosphate for growth. 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.

5.4.56 Studies of the pelagic algae (para. 5.4.52) 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 1960s 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 Deptford Church Street CSO

5.4.57 None of the species recorded in Vol 23 Plate 5.4.1 or Vol 23 Table 5.4.7 have protected 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

5.4.58 Using the baseline set out above the value accorded to each receptor considered in this assessment is set out in Vol 23 Table 5.4.8 below. The definitions of the receptor values and sensitivities used in this evaluation are set out in Vol 2 Section 2.4.

Vol 23 Table 5.4.8 Aquatic ecology – Summary of receptors and their values/sensitivities at Deptford Church Street CSO

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

Operational base case

5.4.59 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 be significant reduction in the occurrence of mass or population level fish mortalities with these schemes in place (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 Deptford Storm Relief CSO will 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). Therefore recovery due to water quality improvements will be suppressed at the Deptford Storm Relief CSO discharge point. 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 will 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.

5.4.60 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 works upgrades at Mogden, these fluctuations are likely to be reduced. Whilst there may be minor changes, increases in abundance and diversity will 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 Deptford Storm Relief 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.

5.4.61 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.

5.4.62 The Convoys Wharf development described in para. 5.3.8 would have no effects on the operational base case. Furthermore 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 2011* (LA, 2011)[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 92% 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 project improvements would ensure compliance with the DO standards described in para. 5.4.28. These improvements are assessed at a river wide level in Vol 3 Section 5. The impact is considered to be medium positive due to the relatively large magnitude of the Deptford Storm Relief CSO, and impacts would be probable 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 92% from approximately 500t to approximately 41t, in the Typical Year with beneficial effects on aquatic ecology receptors. This is considered to be a low positive impact and would be near certain and permanent.

Operational effects

5.6.5 The following section describes the effects of these impacts on aquatic ecology receptors based on the significance criteria set out in Vol 2 Section 3. Only those impacts which are considered relevant to each receptor are assessed, in accordance with the methodology presented in Vol 2 Section 5.

5.6.6 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

5.6.7 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 of 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 to **negligible** at Year 1 increasing to **minor beneficial** by Year 6 on a receptor of medium-high (metropolitan) value.

Marine mammals

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

5.6.8 No changes are anticipated on marine mammals as a result of the water quality improvements associated with interception of a single CSO discharge. This is because marine mammals 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 positive impact magnitude on a low-medium (local) value receptor.

Fish

Reduction in the occurrence of dissolved oxygen related fish mortalities

5.6.9 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 Section 5. In summary, all tidal Thames fish populations would become sustainable (i.e. 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).

5.6.10 Interception of the Deptford Storm Relief 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

5.6.11 The tidal Thames currently supports a small number of rare fish species such as salmon, sea trout, twaite shad and river lamprey (*Lampetra 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.

5.6.12 EA data and bespoke project surveys have indicated no records of rare fish species in the vicinity of the Deptford Storm Relief CSO. 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

5.6.13 Intertidal habitat in the upper and middle Tideway 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. 5.6.7 and the invertebrate community becomes more diverse (para. 5.6.14 to 5.6.19) 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

5.6.14 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 would occur under the base case due to the Lee Tunnel and sewage 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.

5.6.15 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.

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

5.6.17 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** in Year 1, rising to **minor beneficial** in Year 6 of operation as it would take time for new species to colonise.

Increase in the distribution of rare and pollution sensitive invertebrate species

5.6.18 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 a significant 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.

5.6.19 EA data and bespoke project surveys have indicated one species of nationally rare (RDB) invertebrate (*A. lacustre*) present in the vicinity of the Deptford Storm Relief CSO 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

5.6.20 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.

5.6.21 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 negligible impact magnitude and the low-medium (local) receptor value.

Sensitivity test for programme delay

5.6.22 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 - 5.6.21). This is because there are no developments in the site development schedule (see Vol 23 Appendix N) relevant to aquatic ecology and therefore the base case would remain as described in paras. 5.4.59 - 5.4.62.

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 (see Vol 23 Appendix N) 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 Deptford Church Street since the effects on aquatic ecology receptors are associated only with the improvements in water quality arising from interception of the Deptford Storm Relief 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 would be implemented.

5.9 Residual effects assessment

Operational effects

5.9.1 As no mitigation measures are proposed, the residual operational effects remain as described in Section 5.5. All residual effects are presented in Section 5.10.

5.10 Assessment summary

Vol 23 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 habitat	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 rare and 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 23: Deptford Church Street site assessment

Section 6: Ecology - terrestrial

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Thames Tideway Tunnel

Environmental Statement

Volume 23: Deptford Church Street 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 Deptford Church Street site.

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

a. vegetation clearance, and subsequent habitat reinstatement and creation

b. construction and site activities.

6.1.3 Operational effects for terrestrial ecology for this site have been scoped out. This is on the basis that permanent operational lighting is minimal and complies with the lighting design principles to minimise light spill, and maintenance works are limited to intermittent visits to site by maintenance personnel and vehicles. No significant operational effects are considered likely and for this reason only construction effects are assessed.

6.1.4 Contaminated runoff and atmospheric pollution are not considered in this assessment, as these would be controlled through the implementation of the *Code of Construction Practice* (*CoCP*)[i].

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.

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 (Volume 23 Deptford Church Street 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.

[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).

Construction

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

a. removal of 45 semi-mature trees, scrub, semi-improved grassland and tall ruderal vegetation and demolition of a wall as a result of site clearance, with replacement planting

b. construction works that would create noise and vibration, such as the use of construction machinery and vehicles, demolition and shaft excavation.

c. artificial lighting of the site in evenings during winter and for short periods of extended working

d. installation of a brown roof on the electrical and control kiosk providing foraging habitat and refuge for birds and invertebrates.

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 (e.g. 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 (Section11) states that replacement native trees would be provided for those removed during construction.

Environmental design measures

6.2.6 The following measures to minimise adverse effects or provide biodiversity enhancements have been incorporated into the project design:

a. where practicable, trees removed shall be replaced as close as possible to the current position or within close proximity to the site

b. reinstatement of grassland with a species-rich plant mix including the fiddle dock (*Rumex pulcher*)

c. nest boxes attached to replaced trees to attract a range of bird species

d. a brown roof on the electrical and control kiosk.

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*.

6.3.2 The *Scoping Report* was prepared before Deptford Church Street site had been identified as a potential site. The scope for terrestrial ecology for this site has therefore drawn on other scoping responses, feedback from biodiversity workshops held with statutory stakeholders, which were attended by London Borough (LB) of Lewisham officers, and phase two consultation comments.

6.3.3 Specific comments relevant to this site for the assessment of terrestrial ecology are presented in Vol 23 Table 6.3.1.

Vol 23 Table 6.3.1 Terrestrial ecology – stakeholder engagement

Organisation	Comment	Response
London Borough of Lewisham (phase two consultation response – February 2012)	Deptford Church Street is classified as a Site of Importance for Nature Conservation (SINC) in the adopted UDP and as such is protected by policy OS 12 'nature conservation on designated sites' and OS 13 'nature conservation'. If the borough were the local planning authority for this application it would either refuse permission that had adverse impacts on nature conservation or if development was	An assessment of the effects of the proposed development on this SINC and the habitats and species associated with it, is provided in Section 6.5.

Organisation	Comment	Response
	considered essential it would require an environmental appraisal that included methods of mitigation and proposals for compensation. At a minimum the council considers Thames Water should provide this information.	
London Borough of Lewisham (phase two consultation response – February 2012)	The impacts identified by Thames Water include the loss of medium mature trees and associated bird nesting potential as well as the loss of an area containing ruderal meadow species. These impacts are based upon a Habitat Survey carried out by Thames Water that is technically deficient in several areas. The survey lacks any detail; it was carried out in mid February which is a sub-optimal time of year for identifying any notable plant species. The survey judges that the site is species-poor and/or of limited intrinsic value and therefore of 'low' habitat value. This is a subjective and generalised assessment illustrated by the fact that it failed to identify notable species in Lewisham. Furthermore no assessment has been made of the flora and fauna that might be associated with the historic wall. If the project is to go ahead, Thames Water must provide a detailed environmental appraisal demonstrating that there are no negative impacts on the ecological value of the area in line with the Core Strategy Objective 7 and Core Policy 12.	The Phase 1 Habitat Survey, although undertaken in winter was able to identify the likely presence of grassland and herbaceous species. In addition to the Phase 1 Habitat Survey, detailed information contained within the SINC citation has been used to inform the baseline for the Deptford Church Street site. This data have also been supplemented by biological records provided by Greenspace Information for Greater London (GiGL) and a botanical survey undertaken on 12 December 2012. The baseline is therefore considered robust. The ecological value of the wall has been assessed in para. 6.4.9.
London Borough of Lewisham (Section 48 consultation response - October 2012)	The report on phase two consultation does not identify or respond to LBL objections regarding the survey methodology and presence of notable species. This report does however state that in relation to operational effects, surveys have been completed and mitigation measures have been developed. LBL have not seen or	A Phase 1 Habitat Survey has been undertaken of the site as well as bat surveys. The Phase 1 Habitat Survey results are provided in Section 6.4. The

Organisation	Comment	Response
	reviewed the surveys and it is therefore uncertain whether or not the surveys have responded to LBL's areas of concern and incorporated LBL's suggestions. LBL request a copy of any updated surveys and survey methodology. The section 48 Project description and environmental information report is very narrow in its focus, only referring to bat species, and does not refer to the impact on plant species.	effect of temporary loss of habitat is assessed fully in Section 6.5. The citation for the site mentions the fiddle dock as an interest features. The operational design includes the reinstatement of the grassland habitat including fiddle dock.
	Without a full ecological assessment, including a full assessment of mitigation measures, TTT cannot reasonably assert that "the scheme is not expected to have any detrimental effects on ecology". TTT have failed to identify notable species on site, have not provided an impact assessment and have not proposed any mitigation. Therefore significant effects have not been considered and the project should not progress until the impact of the development and the level of proposed mitigation is known and shown to be acceptable.	Details of measures to be implemented during construction are detailed in the *CoCP*. Habitat reinstatement is detailed in the design principles. The assessment of effects identifies impacts but with embedded environmental measures, these impacts are not considered to have significant adverse effects on ecological receptors (Section 6.5).

Baseline

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

a. desk study

b. a Phase 1 Habitat Survey was undertaken on 18 February 2011

c. bat triggering surveys (remote recording surveys) were undertaken over three nights between 24 and 26 June 2011

d. a botanical survey was undertaken on 12 December 2012.

Construction

6.3.5 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.

6.3.6 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 6.

6.3.7 The St Paul's Churchyard and Crossfield Street Open Space SINC (Grade L) designated site is located on site and is therefore considered within the assessment. The Sue Godfrey SINC (Grade B) is located in close proximity to the site and it is considered that there is potential for effects to arise, and is therefore considered in the assessment. No likely effects on any other designated sites due to proposed construction works have been identified. However, the baseline includes details of all designated sites within 250m of the site for completeness (see para. 6.4.1 to 6.4.4c).

6.3.8 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.

6.3.9 The assessment of effects considers bats and 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.

6.3.10 Section 6.5 details the likely significant effects arising from the construction at the Deptford Church Street 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, and therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

6.3.11 No change to the base case conditions for terrestrial ecology are considered likely from the proposed developments listed in Vol 23 Appendix N that would be complete and operational during construction, due to the isolated location of these developments from the proposed development site, within the urban context.

6.3.12 The Giffin Street regeneration area scheme which lies 50m to the south of the site would be under construction during the same time as construction at the Deptford Church Street site. This development is therefore considered in the cumulative effects assessment for Deptford Church Street site (Section 6.7).

6.3.13 Other developments listed in Vol 23 Appendix N that would be under construction during the same time as construction at the Deptford Church Street site are not considered within the cumulative effects assessment (Section 6.7). This is due to the isolated nature of the development from the Deptford Church Street site, within the urban context.

6.3.14 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

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

Assumptions

6.3.16 It is assumed for the purposes of assessment that the current use of the Deptford Church Street site (described in Vol 23 Section 2) will continue as at present.

Limitations

6.3.17 The botanical survey was undertaken during winter when some plants are dormant. This can limit the survey results where annual plants that grow from seed can be missed. However, an experienced botanist identified all other plants by the above and below ground growth of plants present. The general composition and species-richness of the grassland sward can be inferred from the species present. The experienced botanist used professional judgement to determine whether any unrecorded protected and otherwise notable plant species are likely to naturally occur at the site. Therefore, this survey is considered to be sufficient to determine the value of the habitat for the purposes of this assessment.

6.4 Baseline conditions

6.4.1 The following section sets out the baseline conditions for terrestrial ecology 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 the Vol 23 Deptford Church Street Figures.

Current baseline

Designated sites

6.4.2 The Deptford Church Street site lies within the St Paul's Churchyard and Crossfield Street Open Space SINC (Grade L[ii]) and is shown on Vol 23 Figure 6.4.1 (see separate volume of figures). The SINC comprises the adjacent churchyard, which contains the main features of ecological interest, and the site itself. The churchyard comprises semi-improved

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

grassland and mature trees. The Deptford Church Street site mainly comprises species-poor amenity grassland with scattered trees, and a small area of semi-improved grassland with tall ruderal vegetation that contains fiddle dock (*Rumex pulcher*), which is a scarce plant species in Lewisham. This site is of low-medium (local) value.

6.4.3 The Sue Godfrey Local Nature Reserve (LNR) is an urban park located approximately 30m east of the site, adjacent to Deptford Church Street. It is also a designated SINC (Grade B[iii]). The site comprises a mixture of rough grassland, scrub and ruderal vegetation. More than 200 species of wild flowers, shrubs and trees have been recorded. It is of medium-high (metropolitan) value.

6.4.4 The following designated sites are within 250m of the proposed development site and are isolated from the site within the urban context, and are therefore not considered further in this assessment:

a. Creekside Centre SINC (Grade L[ii]) is located approximately 240m to the southeast of the site and comprises an environmental centre and mosaic of brownfield land habitat.

b. St Nicholas Churchyard SINC (Grade B[iii]) is located approximately 240m north of the site and comprises a garden area/amenity space.

c. The River Thames and Tidal Tributaries SINC (Grade M[iv]) is located approximately 250m to the east (Deptford Creek) and 600m to the north (River Thames) of the site and comprises inter-tidal habitat and river channel.

Habitats

6.4.5 Habitats recorded within the survey area during the Phase 1 Habitat Survey are described in Vol 23 Table 6.4.1 and shown on Vol 23 Figure 6.4.2 (see separate volume of figures). Target notes (TN#) are indicated on this figure and are referred to within the text below.

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

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

Vol 23 Table 6.4.1 Terrestrial ecology – Phase 1 Habitat Survey

Habitat type	Habitat description
Hardstanding	The roads and pathways within the survey area comprise hardstanding.
Semi-improved grassland	The semi-improved grassland comprises common grasses and herbs (for full details see the botanical survey results in paras 6.4.18-6.4.21).
Scattered trees	A number of semi-mature trees occur largely around the periphery of the survey area and have been planted for landscaping purposes. Mature trees are located adjacent to the north of the survey area, associated with the churchyard. Species include a range of native and non-native species such as tree of heaven (*Ailanthus altissima)*, walnut (*Juglans* sp.), London plane (*Platanus* × *acerifolia)*, common lime (*Tilia* × *europaea)*, horse chestnut (*Aesculus hippocastanum)*, cherry (*Prunus* spp.), Norway maple (*Acer platanoides)* and false acacia (*Robinia pseudoacacia)*.
Ruderal vegetation	Located in the southwest of the survey area is a small embankment which has been colonised by ruderal vegetation and butterfly-bush (*Buddleia davidii)*.
Other	A brick wall runs north-south through the centre of the survey area (TN1).

6.4.6 The semi-improved grassland is species-poor, common and can easily be recreated. These species are common and widespread in the UK and indicative of semi-improved neutral grassland. This habitat type is common in the squares and parks in London and throughout the UK, and complements the similar habitat present in the Sue Godfrey LNR to the east of the site. The habitat on site is relatively small but provides some value to the biodiversity resource in the local area. Therefore, the semi-improved neutral grassland is considered to be of low-medium (local) value.

6.4.7 The tree species present on site comprise a mixture of native species and non-native species, all of which are relatively common in the UK and the south east of England. The majority of these trees are young. In the LB of Lewisham, trees are less common due to the urban hard landscaping that dominates these areas. However, given the young age of these trees, they have limited intrinsic value and are neither UK nor London Biodiversity Action Plan (BAP) priority species. Therefore, the scattered trees identified on site are considered to be of low (site) value.

6.4.8 Ruderal vegetation on site mainly comprises common plant species and is likely to support the scarce plant species, fiddle dock. This habitat is considered to provide a limited contribution to the local habitat resource due to the species composition and small extent of habitat. Therefore, this habitat is considered to be of low (site) ecological value.

6.4.9 The brick wall and hardstanding on site in this location do not have any significant biodiversity interest as habitats, and are of negligible value.

Notable species

6.4.10 Survey results are set out in a notable species report, which is included in Vol 23 Appendix D.1. A summary of the results and an assessment of the value of species associated with the site are set out below.

Bats

6.4.11 During the Phase 1 Habitat Survey the potential for bats to use the site for foraging purposes was identified. The potential for bats to use the adjacent church and church grounds for roosting and foraging purposes was also identified. Consequently, remote recording surveys were undertaken.

6.4.12 All bats are European Protected Species (EPS) under the Conservation of Habitats and Species Regulations 2010. Seven of the 18 bat species that regularly occur in England are listed as priority species on the UK BAP. Nine bat species are listed on the London BAP including common pipistrelle (*Pipistrellus pipistrellus)* and soprano pipistrelle (*Pipistrellus pigmaeus)*. These two species were recorded on site. Detailed survey results are provided in Vol 23 Appendix D.1 and on Vol 23 Figure 6.4.3 (see separate volume of figures).

6.4.13 The common pipistrelle bat is the UK's most common bat species, and is a widespread species in Greater London. Soprano pipistrelle bat is also widespread and common across Greater London but has a smaller UK population than the common pipistrelle. Both species are in decline mainly due to habitat loss (London Bat Group, 2012)[3].

6.4.14 Bat triggering surveys indicated that the site is used by a small number of foraging common pipistrelle and soprano pipistrelle bats, most likely for foraging around the trees on site. These species were only recorded on one of the three survey nights, with four common pipistrelle and two soprano pipistrelle bat passes. None of those recorded were close to sunset or sunrise, indicating that bats are not roosting on or in close proximity to the site.

6.4.15 With consideration to the conservation status of both common pipistrelle and soprano pipistrelle, and the size of the populations using the site relative to their UK populations, both the common pipsitrelle and soprano pipistrelle bat populations associated with the site and its immediate surrounds are considered to be of low (site) value.

Breeding birds

6.4.16 During the Phase 1 Habitat Survey the scattered trees on site were identified as having some potential to support nesting birds. This habitat is

limited in extent and it was therefore not considered necessary to undertake breeding bird surveys.

6.4.17 Any birds that are likely to nest within vegetation on site are likely to comprise bird species common to the area, including some that are listed as London and UK BAP priority species. However, the number of nests that the vegetation on site could support is limited. The bird resource associated with the site is likely to be of low (site) value.

Botanical

6.4.18 Due to the designation of the site as a SINC and following feedback from consultation, a botanical survey was undertaken of the grassland habitat. Detailed survey results are provided in Vol 23 Appendix D.1 and on Vol 23 Figure 6.4.4 (see separate volume of figures).

6.4.19 The management of the grassland varies with a tall sward due to infrequently mowing. The remainder of the site comprises a short mown sward. The composition of the sward was similar between both areas of management, although moss species were slightly more abundant in the short mown sward.

6.4.20 The grassland is dominated by perennial rye-grass (*Lolium perenne*) and common bent *(Agrostis capillaris*) with abundant yarrow (*Achillea millefollium*) and ribwort plantain (*Plantago major*). Red fescue (*Festuca rubra*) and smooth meadow grass (*Poa pratensis*) frequently occur with occasional presence of other common grasses and forbs. The common mosses comprise rough-stalked feather moss (*Brachythecium rutabulum*) and springy turf-moss (*Rhytidiadelphus squarrosus*).

6.4.21 No notable botanical species were recorded on site during the survey, and the species are readily available from suppliers of seed mixes. Therefore, botanical species are not considered further within the assessment.

Noise, vibration and lighting

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

6.4.23 The source of noise and vibration currently associated with the site area is dominated by road traffic noise from the A2209 Deptford Church Road, and to a lesser extent from Deptford High Street and other more distant roads. Frequent passenger train movements along the mainline railway to the south of the site also contribute to the overall noise and vibration climate in this area.

6.4.24 The site is lit at night by street lighting. The density of the surrounding built environment means that the site is influenced by light spill from street lights and residential properties.

Construction base case

6.4.25 Assuming use of the site continues as at present, conditions in Site Year 1 of construction would be the same as the current baseline conditions.

6.4.26 The base case, taking into account the schemes described in Vol 23 Appendix N, would not change due to the isolated nature of these

schemes from the site, in the urban context. Therefore, no change in ecological value of the Deptford Church Street site or surrounding area is considered likely.

6.4.27 The noise and vibration base case is described in detail in Section 9 of this volume. Noise levels are likely to be similar to those currently present on and in close proximity to the site, with slight increases in noise experienced due to an anticipated increase in traffic levels adjacent to the site. No new sources of vibration are anticipated. Therefore, the levels of vibration would be the same during Site Year 1 of construction as they are at present.

6.4.28 No change in light conditions is anticipated.

6.5 Construction effects assessment

Construction impacts

Habitat clearance and creation

6.5.1 Habitat of low (site) and negligible value would be removed as part of construction works. This habitat comprises a brick wall, amenity grassland, scattered trees, scrub and ruderal vegetation. This would affect breeding birds that nest and forage within this habitat, and bats that forage and commute on site.

6.5.2 Habitat would be reinstated on site including at least the same number of trees as that lost on site. Nest boxes would be installed on trees to attract a range of bird species to the site. A brown roof would be installed on the electrical and control kiosk; this would be of benefit to birds and invertebrates.

Noise, vibration and lighting

6.5.3 Noise and vibration impacts are based upon the data and assessment in Section 9 of this volume. Noise and vibration is likely to increase during construction with the greatest increases in noise levels experienced during site clearance and during shaft sinking (mainly from piling). These activities could cause disturbance to any breeding birds nesting within trees adjacent to the site, such as within the churchyard to the north of the site. As no roosts have been identified in close proximity to the sites and given that the majority of the works would be undertaken during the day and bats fly through the site at night, it is considered unlikely that bats would be disturbed by increased noise and vibration levels.

6.5.4 Background light levels are high. With measures in place as part of the *CoCP* Part A (Section 4), it is considered likely that additional light spill from the site onto adjacent habitats would be minimal. No impacts on species from lighting are anticipated.

Construction effects

Designated sites

6.5.5 Site clearance would result in the loss of a small area of habitat (trees, amenity grassland, semi-improved grassland and ruderal vegetation)

within the St Paul's Churchyard and Crossfield Street Open Space SINC (Grade L[ii]). The extent of the SINC would be reduced for the duration of the works. There would also be the temporary loss of the notable plant species, fiddle dock, from the site during this period. The plant is scarce in Lewisham and therefore would be planted or seeded upon completion of construction. There would be no long-term effect on the quality of the habitats within the SINC site. Therefore, the effect on the designated site is considered to be probable, **negligible** and not significant.

6.5.6 The Sue Godfrey Local Nature Reserve is designated for its public amenity use and the habitats that the nature reserve supports. Breeding birds are also likely to be present in this nature reserve. There would be an increase in traffic activity immediately adjacent to the west of this designated site, which could cause disturbance to birds on the periphery of the site. However, there would be no reduction in extent of the designated site or changes to the habitats for which it has been designated. Therefore, the effect of the proposed development on this site is considered to be probable, **negligible** and not significant.

Habitats

6.5.7 The loss of amenity grassland, trees, and scrub/ruderal vegetation, and the subsequent habitat creation and reinstatement of this vegetation following the completion of works, is considered likely to result in no significant change in the local habitat resource in the long term. Therefore, the effect is considered to be probable, **negligible** and not significant.

6.5.8 There would be the loss of a small area of semi-improved grassland, including the locally scarce fiddle dock species, which is of low (site) value. The fiddle dock would be reinstated upon completion of the works, where present. Therefore, the effect would be probable, **negligible**, and not significant.

Species

Bats

6.5.9 There would be temporary loss of foraging habitat for bats on site. However, the majority of alternative habitat in the Sue Godfrey Local Nature Reserve to the east of the site and around trees and scrub within the church grounds to the north of the site would not be affected. Foraging habitat would be reinstated following completion of works and additional foraging habitat would be provided by a brown roof, which would be installed on the electrical and control kiosk. Therefore, bats that forage on site are likely to continue foraging with the wider area. This is unlikely to result in a change to local bat populations. Therefore, the effect is considered to be probable, **negligible** and not significant.

Breeding birds

6.5.10 There would be temporary loss of nesting opportunities on site. As the number of breeding territories is likely to be small relative to their existing populations, it is considered unlikely that the loss of nesting habitat for a small number of birds would result in perceptible changes to their

populations. Therefore, this effect is considered to be probable, **negligible** and not significant.

6.5.11 Birds on and adjacent to the site are likely to habituate to changes in noise and vibration levels. Suitable breeding bird habitat is available within the wider area and any birds displaced could move to these areas. Any change in populations would not be perceptible against background population fluctuations. The displacement effect would be reversed following the completion of construction works. Therefore, the effect of disturbance on breeding birds is considered to be probable, **negligible** and not significant.

6.5.12 Bird boxes would provide habitat for bird species, which is likely to increase the number of breeding territories of common breeding birds in the area. Birds would also be supported by a small increase in foraging resource from the proposed brown roof. This increase is considered to be small relative to the existing population sizes of these species in the area. Therefore, the effect would be probable, **minor (site) beneficial** and not significant.

Sensitivity test for programme delay

6.5.13 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 - 6.5.12). This is because there are no developments in the site development schedule (see Vol 23 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. 6.4.25 - 6.4.28.

6.6 Operational effects assessment

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

6.7 Cumulative effects assessment

Construction effects

6.7.1 As detailed in para. 6.3.12, the land at Giffin Street located 50m to the south of the site will be undergoing redevelopment during the construction phase of the Thames Tideway Tunnel project.

6.7.2 Cumulative effects such as vibration, noise and lighting may have some short-term negative impacts upon birds and bats such as, displacement to other suitable areas of habitat nearby. However, it is considered unlikely that these changes would result in significant long-term effects on populations as the wider area supports a range of opportunities for nesting birds, and foraging and roosting bats. Therefore the effects on terrestrial ecology would remain as described in Section 6.5 above.

6.7.3 No significant cumulative effects have been identified for the construction phase at this site.

Sensitivity test for programme delay

6.7.4 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 - 6.7.3, 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.

6.9 Residual effects

6.9.1 As no mitigation measures are proposed for any other effects on ecological receptors, 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 23 Table 6.10.1 Terrestrial ecology – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Designated sites				
St Paul's Churchyard and Crossfield Street Open Space SINC (Grade L[v])	No significant effect on the integrity of the SINC site due to temporary loss of an area of the SINC (Grade L) as the reinstatement and creation of habitat following completion of works include the reintroduction of the fiddle dock plant species.	Negligible	None	Negligible
Sue Godfrey Local Nature Reserve	No significant effect on the integrity of the Local Nature Reserve.	Negligible	None	Negligible
Habitats				
Scattered trees amenity grassland, scrub and ruderal habitat	No significant change in habitats as habitats lost during construction would be replaced on completion of works.	Negligible	None	Negligible
Semi-improved grassland	Temporary loss of a small area of semi-improved grassland, including the locally scarce Fiddle Dock species, which	Negligible	None	Negligible

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

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
	would be reinstated upon completion of works.			
Species				
Bats	No significant changes in bat populations as a result of a temporary loss of foraging habitat.	Negligible	None	Negligible
	No significant changes in bat populations as a result of the installation of a brown roof	Negligible	None	Negligible
Breeding birds	No significant changes in populations of breeding birds due to the temporary loss of habitat.	Negligible	None	Negligible
	No significant change in bird populations as result of low levels of disturbance from noise, and vibration.	Negligible	None	Negligible
	An increase in nesting opportunities and foraging resource (brown roof) on site is likely to result in a small increase in local breeding bird populations.	Minor beneficial	None	Minor beneficial

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).

[3] London Bat Group. *Greater London Bat Action Plan.* (2012). Available online at: http://londonbats.org.uk/lbpsap.htm. Accessed 19 January 2012.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 7: Historic environment

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Thames Tideway Tunnel

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Thames Tideway Tunnel

Environmental Statement

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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 Deptford Church Street site. The historic environment is defined in para 4.10.2 of the National Policy Statement for Waste Water (NPS)[1] 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 and operation are assessed with effects on buried assets presented first, followed by above-ground assets.

7.1.2 The construction assessment includes an assessment of the effects of ground movement generated by tunnelling and deep excavations (in this case ground settlement). As the ground movement would be generated by construction activity and any damage would be greatest for the period of construction, an assessment has not been undertaken of operational effects on above ground heritage assets from ground movement. An assessment of effects from ground movement resulting from the whole Thames Tideway Tunnel project is covered in Volume 3 Project wide effects.

7.1.3 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.

7.1.4 The operational phase would not involve any activities below-ground aside from maintenance; therefore an assessment has not been undertaken of operational effects on buried assets.

7.1.5 A separate but related assessment of effects on townscape character and visual amenity is included in Section 11 Townscape and visual.

7.1.6 The assessment of the historic environment effects of the project has considered the requirements of the NPS. As such the assessment covers designated and non-designated assets, and a description of the significance of each heritage asset affected by the proposed development and the contribution of their setting to that significance. 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.

7.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 23 Deptford Church Street 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. Those in the vicinity of St Paul's Church and the listed London to Greenwich railway viaduct would cause ground movement that could potentially induce damage to the listed building. Below ground works are described below. Works above ground are also described, where relevant.

7.2.3 Demolition works would require the removal of a 19th/early 20th century wall running north-south across the centre of the site (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 (see Construction phase 1 plan, separate volume of figures - Section 1).

7.2.5 Permanent below-ground works include deep excavation for the construction of a combined sewer overflow (CSO) drop shaft in the centre of the site. Deep excavations would also be required for the construction of an interception and valve chamber, ventilation structures, two ventilation ducts and a connection culvert from the CSO drop shaft to the interception chamber (these elements would be constructed within the zones shown in the Site works parameter plan, see separate volume of figures - Section 1).

7.2.6 A permanent above-ground electrical and control kiosk and ventilation columns would also be constructed (again within the zones shown in the Site works parameter plan, see separate volume of figures - Section 1).

7.2.7 Ground intrusion from tree removal and landscaping (tree planting, root action and paving) is assumed for the purposes of this assessment to reach a depth of approximately 1.5 metres below ground (mbgl) (landscaping would occur within the zone shown in Site works parameter plan, see separate volume of figures - Section 1).

7.2.8 The construction activities which may give rise to effects on the character and setting of heritage assets are:

a. demolition of a late 19th/early 20th century brick wall running north to south across the centre of the site (see Demolition and clearance plan, separate volume of figures - Section 1), and the partial removal of a 19th-century cobbled surface within the southern part of the site (as assumed for the purposes of this assessment)

b. establishment of hoardings around the boundary of the construction site

c. use of cranes and other plant during shaft construction

d. provision of welfare facilities

e. lighting of the site when required.

Code of Construction Practice

7.2.9 Measures incorporated into the *Code of Construction Practice* (*CoCP)* Part A (Section 12) to protect heritage assets and relevant to this site 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. It would also address any effects from third-party impacts, vibration, ground movement and dewatering.

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. Condition surveys to define ground movement and vibration limits for heritage assets potentially affected by the works - to include monitoring regimes and provision for cessation of works where feasible, should levels exceed the specified limits.

e. Procedures under the *Emergency Preparedness Plan* (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.

7.2.10 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).

7.2.11 Section 13 of the *CoCP* details the approach to third party impact and the asset protection process in relation to ground movement. This includes measures for the contractor to undertake a condition survey of the relevant infrastructure and buildings prior to commencing works that could impact them. The contractor would put in place protection measures during construction to minimise the impact to third-party infrastructure and buildings as a result of ground movement. Monitoring would be carried out prior to commencement of construction work to enable baseline values to be established and would continue until ground movement due to the works, as shown by the monitoring, has effectively ceased. Post condition surveys would be carried out, as well as installation of instrumentation and monitoring to confirm that ground movements is as predicted and acceptable. An Emergency Planning and Response Plan would be developed in conjunction with the asset owner to include relevant contingency plans and trigger levels for action.

7.2.12 No site specific measures are incorporated in the *CoCP* Part B (Section 12).

7.2.13 All the measures detailed above form part of the proposed 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 the *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.

Operation

7.2.14 The operation of the proposed development at the Deptford Church Street site is described in Section 3 of this volume. The particular components of importance to this topic include the design of the public realm and the design and siting of the proposed ventilation structure and electrical kiosk.

7.2.15 The operational design has been developed through close liaison with stakeholders, including English Heritage, and in response to early iterations of the environmental impact assessment, through a series of design workshops, as well as in response to other design factors, such as operational requirements. The design process has therefore helped to minimise effects on the character, appearance and setting of heritage assets. Such design decisions are 'embedded' within the proposed development which has been assessed. Alternatives to the project, including design iterations, are fully detailed in Section 3 of this volume.

Historic environment design measures

7.2.16 A high quality design in keeping with the character of the surrounding townscape has been proposed for the development of this site to minimise

adverse effects on the historic character, appearance setting of heritage assets in accordance with the design principles set out in Vol 1 Appendix B. Generic design principles of relevance to the historic environment at this site include:

a. All the principles that apply at the site relating to the integration of functional components including those relating to materials, signature designs and detailing since they would inform the final appearance of the operational infrastructure at this site.

b. Those heritage design principles that apply at the site relating to interventions to the fabric of listed buildings, and to designs supporting the legibility of key historic functions of heritage assets.

c. All the landscape principles that apply at this site including those related to soft and hard landscaping, materials and public accessibility.

7.2.17 The following site-specific design principles are also relevant:

a. The extent of hard standing within the site boundary would be reduced as far as possible

b. The design would enhance the setting of the listed church by providing a more integrated and accessible public space.

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 (EH) and other stakeholders. Vol 23 Table 7.3.1 below summarises the comments raised by consultees and how each comment has been addressed.

7.3.2 The *Scoping Report* was prepared before the Deptford Church Street site was identified as a potential site. The scope for the assessment of historic environment effects for this site has therefore drawn on the scoping response from the LB of Lewisham in relation to other sites and is based on professional judgement as well as experience of similar sites.

7.3.3 In addition to the consultation detailed below, the design at this site has been developed in light of consultation, which has been undertaken throughout the pre-submission phase, with consultees including English Heritage. Consultation has highlighted the need for the design to be sensitive to the setting of the Grade I listed St Paul's Church, the character and appearance of the St Paul's Conservation Area, and the need to successfully integrate the works into an existing area of public realm and create an understated design for the proposed public open space, so that the space would continue to provide views of the south side of the church, at the same time as improving the views over and past the public open

space, without being at variance with the existing character of the Church's setting.

Vol 23 Table 7.3.1 Historic environment – consultation response

Organisation and date	Comment	Response
English Heritage phase two consultation response (February 2012)	EH raised specific points about the extents and descriptions of several assets including St. Paul's Churchyard wall and the listed railway viaduct.	The nature and extent of built heritage assets, including St. Paul's Churchyard and the listed railway viaduct are detailed in this assessment.
	The cobbled entrance and kerb leading off Crossfield Street should be retained / reinstated if possible, as it contributes to the conservation area.	In light of operational and design requirements at this site, preservation by record is proposed for the cobbled surface in proportion to its low asset significance.
	EH considers that this site demands a range of mitigation, enhancement and compensation measures to minimise harm to St Paul's Church and to ensure its viability through the construction phase. EH has suggested a range of measures which could make up such a package, including compensation for loss of income during the construction phase, renewal and repair of the churchyard wall and gates and works to improve community access.	Measures to address temporary effects arising through the construction phase from noise and effects on social and economic aspects of the Church are detailed in Sections 9 and 10, respectively. During the operational phase beneficial effects are predicted on the Church, and therefore no mitigation measures are considered necessary during this phase.
London Borough (LB) of Lewisham phase two consultation response (February 2012)	The site is within an archaeological priority area. The significance of heritage assets, the impacts of the works on them and details of mitigation measures are therefore required in accordance with LPA policy.	The assessment presented here details the significance of all heritage assets and the likely significant effects of the works on them and proposes a range of mitigation measures to address them.
	A historic wall on the site, identified as being part of the rectory once attached to St Paul's, would be destroyed or materially	Historical research undertaken as part of this assessment indicates that the wall is not associated with the rectory but with

Organisation and date	Comment	Response
	damaged.	residential buildings of 19th/20th century date.
	The railway viaducts running along the southern boundary of the site are listed.	This asset and its listed status are noted in the assessment.
English Heritage meeting on the assessment of setting (2 May 2012)	The adverse effect on the unlisted brick wall in the centre of the site, whilst of low value, requires further explanation.	This assessment describes the proposal to demolish the wall; details the resulting environment effect, along with appropriate measures to mitigate this effect.
Post meeting correspondence 31st May 2012	EH recommended a more restrained restoration of the open space and subtler enhancement in consultation with the community.	The design for the open space submitted as part of the application is illustrative (rather than for approval) and would be developed in line with the design principles and in consultation with stakeholders.
Targeted Consultation meeting with English Heritage 30 May 2012	English Heritage questioned the sensitivity scores used in the damage assessments for buildings on the 'Heritage at Risk' register and particularly sensitive buildings such as St Paul's Church in Deptford.	It was explained that the methodology assessed the buildings' sensitivity to the movements predicted and that condition and fragility of significant features and materials are considered within the assessment. As the Church is on the edge of the area of movement the movements predicted are miniscule.

Organisation and date	Comment	Response
LB of Lewisham Section 48 consultation response (October 2012)	There should be a full assessment that covers potential damage to the brick wall identified as part of the demolished St Paul's Rectory, as well as works directly affecting the setting and structural integrity of the listed church, cemetery wall and railway viaduct and Grade II listed 227 Deptford High Street, and setting out what mitigation is proposed. Assessment of all heritage assets is required, including the three conservation areas: Deptford High Street, St. Pauls and Deptford Creekside Conservation Area (now adopted). The scheme will not preserve or enhance the character of the St Pauls conservation area or the setting of the church as the extent of landscaping is limited to a small area.	An assessment has been undertaken of likely significant effects of the construction and operational phases upon built heritage in the assessment area. It considers all relevant heritage assets according to their significance and the potential impact of the works upon them. Likely significant effects upon the setting and structure of the listed church, cemetery wall and railway viaduct have all been assessed, including the effects of ground movement where appropriate (n.b. since settlement effects on 227 Deptford High Street are associated with the Thames Tideway Tunnel itself these are presented in Vol 3 Project wide effects). The conservation areas are included in the assessment as appropriate. Mitigation measures are detailed in Section 7.10, while measures to address effects arising through the construction phase from noise and effects on social and economic aspects of the Church are detailed in Sections 9 and 10, respectively.
	All adverse effects should be identified, and it should be demonstrated that the heritage value of the area would not be harmed following adequate mitigation.	The ES identifies and assesses all effects on heritage assets as appropriate, and presents works of mitigation where this is possible.
	The site is within an area of archaeological priority and	The baseline presented in Section 7.4 describes the

Organisation and date	Comment	Response
	this requires assessment.	area of archaeological priority. A full assessment of effects on buried heritage has been undertaken, and appropriate mitigation is identified.
English Heritage Section 48 publicity comments (October 2012)	The absence of an assessment of secondary, indirect, cumulative, compound and in-combination impacts masks a major adverse impact at Deptford Church Street during construction.	Whilst these terms, with the exception of cumulative effects, are not used in the ES, the ES covers all of these aspects under 'likely significant effects'. St Paul's Church is a receptor in the assessment of socio-economic effects, presented in Section 10. This includes an assessment of amenity effects arising from noise, dust and visual impacts on the church. Cumulative effects arising from Thames Tideway Tunnel project works and non-Thames Tideway Tunnel schemes are assessed in Section 7.7.
	Noise impacts and parking restrictions during the construction phase should be assessed for their potential to impair use of St Paul's Church and affect its revenues, with attendant heritage impacts.	Noise effects are assessed in Section 9 Noise and vibration, amenity effects on the church are assessed in Section 10 Socio-economics, whilst Traffic and transport effects are assessed in Section 12.
	Assessment of the historic environment for this site would benefit from including a summary of the settlement impacts on the various heritage assets.	The *ES* includes an assessment of ground movement effects on listed buildings.
	English Heritage would welcome an explanation of why, in the assessment for this site, the historic	Where these differences exist, the ES includes an explanation in the assessment for each asset.

Organisation and date	Comment	Response
	environment impacts on some heritage assets differ from the townscape impacts.	
	English Heritage notes that Coffey Street could be unavailable to users of St Paul's Church, contributing to adverse cumulative impacts to the asset.	Section 10 Socio-economics assesses effects on users of the church, and traffic and transport effects are assessed in Section 12.
English Heritage Historic Environment Workshop 11 October 2012	English Heritage noted the area south of St Paul's Church has been open space historically and the openness of the setting to the south is important. English Heritage recognises the efforts to represent a full assessment in relation to St Paul's	The ES analysis indicates that the existing open space differs from the originally intended setting of St Paul's Church. The ES is updated to better reflect the contribution of the open space to the setting of the church
	English Heritage needs to understand that the church can withstand construction effects and that its vulnerability is reflected in the HLF funds invested in it recently. English heritage requested further engagement with the church and that beneficial initiatives would help to provide reassurance	Engagement has been undertaken with representatives of St Paul's Church in relation to construction phase effects. Mitigation in relation to noise and other effects for St Paul's Church are presented in Section 9 Noise and vibration and Section 10 Socio-economics.
	English Heritage expressed concern that the assessment does not recognise the intense design consultation process which has taken place and which has produced improvements.	Design iterations are detailed further within Section 3 of Vol 23, and Section 7.3.
	English Heritage remains concerned about Secondary, indirect, cumulative, compound and in combination effects	As noted above, whilst these terms, with the exception of cumulative effects, are not used in the ES, the ES covers all of these aspects under 'likely significant effects'. St Paul's Church is a receptor

Organisation and date	Comment	Response
		in the assessment of socio-economic effects, presented in Section 10. This includes an assessment of amenity effects arising from noise, dust and visual impacts on the church. Cumulative effects arising from Thames Tideway Tunnel works and non-Thames Tideway Tunnel schemes are assessed in Section 7.7.

Baseline

7.3.4 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.

7.3.5 Baseline conditions for above-ground and buried 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 potential of the site to contain buried heritage assets. There are occasional references to assets beyond the baseline area, for example, the discovery of a Palaeolithic axe, approximately 1.5km to the south of the site; excavations at the junction of Deptford Church Street and The Broadway, approximately 450m to the south of the site, and a Saxon settlement at Deptford Bridge, which contribute to current understanding of the site and its environs in these periods.

7.3.6 The assessment area for the assessment of effects on the historic character and setting of above-ground heritage assets has been defined using professional judgement by identifying heritage assets within the Zone of Theoretical Visibility (ZTV) generated as part of the townscape and visual assessment (see Section 11), whose settings have the potential to be significantly affected by the proposed development. The setting of these assets is then described in the baseline. Where appropriate this assessment area extends beyond the 400m baseline area described above. In addition, 'Views of Heritage Value' (VHV) considered important for understanding the historic character and setting of heritage assets have been developed where appropriate. These are drawn from professional judgement based on observation, understanding of historic context and architectural purpose and design, as the St Paul's, Deptford

Creekside and Deptford High Street Conservation Areas do not yet have conservation area appraisals.

7.3.7 A site visit was carried out in March 2011 to identify assets on or adjacent to the site and a further site visit was carried out in January 2012 to identify assets for inclusion within the assessment of effects on setting.

Construction

7.3.8 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.

7.3.9 In terms of physical effects on above-ground 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.

7.3.10 In terms of effects on the character and setting of above-ground heritage assets, while there would be effects throughout the construction period, the peak construction phase is Site Year 1, when the shaft would be under construction and cranes would be present at the site. This has been used as the construction assessment year for effects on the character and setting of heritage assets. The construction assessment area is as described in para. 7.3.5. It should be noted that in some instances, the historic environment setting assessment may differ from the townscape and visual assessment despite the receptors being largely coincident. This is due to the different value / sensitivity that may be attributed to a receptor and also due to consideration of different factors when assessing the magnitude of change and significance of effect (the reasoning for any such differences is further explained in Sections 7.5).

7.3.11 Section 7.5 details the likely significant effects arising from the construction at the Deptford Church Street site. Of the other Thames Tideway Tunnel project sites which could give rise to additional effects on the historic environment within the assessment area for this site, Greenwich Pumping Station is also in the setting of Deptford Creekside Conservation Area. Therefore Greenwich Pumping Station is also considered in this assessment, in relation to effects on Deptford Creekside Conservation Area. Otherwise the other sites are considered too distant from Deptford Church Street, to have significant effects on the setting of heritage assets.

7.3.12 In terms of the construction base case, 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 identified in the development schedule (Vol 23 Appendix N) would lead to physical changes in above or below ground heritage assets within the Deptford Church Street site. 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 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 heritage within the site would be the same as at present.

7.3.13 None of the schemes included in the site development schedule (Vol 23 Appendix N) would change the existing baseline in terms of the assessment of the effects of ground movement, as these schemes would not damage the listed London to Greenwich railway viaduct or St Paul's Church, Deptford, the only heritage assets in the vicinity of the area affected by ground movement from the Thames Tideway Tunnel project.

7.3.14 None of the schemes included in the site development schedule (Vol 23 Appendix N) would change the existing baseline in terms of character and setting of above-ground assets, given the distance of these schemes from the site and the presence of intervening structures.

7.3.15 In terms of cumulative effects, the Giffin Street Regeneration Area is included within the assessment of construction phase cumulative effects on the historic character and setting of above-ground heritage assets. None of the other schemes included in the site development schedule (Vol 23 Appendix N) are included within this assessment due to the relative scale and distance of these schemes from the site and the presence of intervening structures.

7.3.16 The assessment of construction effects on the character, appearance and setting of heritage assets 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, for example due to changes in schemes which form part of the base case or cumulative assessment. In the case of buried heritage, 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 project construction, would not lead to any change in the archaeological baseline and therefore no change in the assessment of effects on these assets.

Operation

7.3.17 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 the historic character and setting of heritage assets which is based on an assessment in Year 1 of operation, when the development's full effect upon its surroundings would be evident. As with the construction assessment, it should be noted that in some instances the townscape and visual assessment may differ to the historic environment assessment, despite the receptors being largely coincident.

This is due to the different value / sensitivity that may be attributed to a receptor and also due to consideration of different factors when assessing the magnitude of change and significance of effect (the reasoning is further explained in Section 7.6 where relevant). The operational assessment area is as described in para. 7.3.5.

7.3.18 As stated in para. 7.3.11, the Thames Tideway Tunnel project site at Greenwich, which could give rise to additional effects on the assessment of the historic environment at this site, has been considered.

7.3.19 In terms of the base case, the Giffin Street development would be complete and operational by Year 1 of operation and this would change the baseline, and is therefore reflected in the operational base case in terms of the character and setting of above-ground heritage assets. None of the other schemes included in the site development schedule (Vol 23 Appendix N) would change the existing baseline given the distance of these schemes from the site and the presence of intervening structures.

7.3.20 As the majority of the schemes detailed in the development schedule (Vol 23 Appendix N) would be complete and operational by the operational phase assessment year, no assessment has been made of cumulative effects on the historic character and setting of above-ground heritage assets. The Heathside and Lethbridge Estate development is not considered within this assessment due to the relative scale and distance of this scheme from the site and the presence of intervening structures.

7.3.21 The assessment of operational effects on the character, appearance and setting of heritage assets 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, for example due to changes in schemes which form part of the base case or cumulative assessment.

Assumptions and limitations

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

Assumptions

7.3.23 The assessment of effects on buried heritage assets is based on the shaft and other below-ground structures being located anywhere within the zones identified on the permanent works plan for these structures. For this site the assessment is not sensitive to variations in location within these zones 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).

7.3.24 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.

7.3.25 The assessment of effects on above-ground assets is similarly based on the above-ground structures being located anywhere within the relevant zones (see Site works parameter plan, separate volume of figures - Section 1).

7.3.26 Assumptions relating to the assessment of effects arising from ground movement are detailed in the project wide assessment in Vol 3 Section 7.

Limitations

7.3.27 A limitation of the assessment is that no intrusive archaeological investigation has been carried out on the site in the past (although several investigations have been carried out within the baseline area around the site). 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 seven 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 23 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 23 Appendix E.1. It

should be noted that the baseline for the assessment of effects on the character, appearance and setting of heritage assets, is informed by professional judgement and the ZTV, with assets described in 'Statement of significance: above-ground heritage assets' later in this section.

Designated assets

International and national designations

7.4.3 The Grade II listed mid 19th century London to Greenwich Railway viaduct (HEA 1D) is located within the southeastern corner of the site. The viaduct is 5.2km long and includes a series of brick arches. The section which lies within the site, where the viaduct crosses over Deptford Church Street, is a modern precast concrete deck with steel railings (see Vol 23 Appendix E.5, Vol 23 Plate E.9). This replaced the original brick structure when Deptford Church Street was widened to a dual carriageway.

7.4.4 The site does not contain any other nationally designated (protected) heritage assets, such as scheduled monuments or registered parks and gardens. Listed buildings close to the site include the Parish Church of St Paul's (HEA 50), adjacent to the north of the site, which is a Grade I listed building, constructed in 1730. The Grade II listed walls of its churchyard (HEA 52) are approximately 25m to the east and outside of the site, across Coffey Street. The walls of the former graveyard belonging to the Old Baptist Chapel are also Grade II listed (HEA 51) and lie immediately adjacent to the northern boundary of the site. Further listed buildings within the baseline area are shown on the historic environment features map (Vol 23 Figure 7.4.1, see separate volume of figures). The significance of assets is described further in the 'Statement of Significance: above ground heritage assets' below in paras 7.4.34 - 7.4.52.

7.4.5 There are no internationally designated assets near the site, the settings of which would be affected by the proposed development.

Local authority designations

7.4.6 The site lies within the southern part of St Paul's Conservation Area, as designated by LB of Lewisham (Deptford High Street St Paul's Conservation Areas Appraisal, 2011)[2]. The conservation area is distinguished by the 18th century classical Church of St. Paul, located immediately to the north of the site, with its surrounding of greenery and churchyard setting. It is characterised by the unique survival and character of a number of timber-framed, pre-19th century houses, along with terraced houses, in particular the early 18th century houses in Albury Street, approximately 160m to the north of the site.

7.4.7 Deptford Creekside Conservation Area is near to the site along the east side of Deptford Church Street. It includes the last remaining industrial riverside quarter on the Creek that retains some coherence, and the Crossfield Estate, a 1930s estate that became a centre of the radical arts music scene in the 1970s and 1980s.

7.4.8 The only locally listed buildings in the vicinity of the site are 167 and 169 Deptford High Street, although there are intervening buildings between these buildings and the site and they are therefore not considered further.

7.4.9 The site lies within the northern part of an Archaeological Priority Area, (APA9: Upper Deptford), as defined by LB of Lewisham (Lewisham Local Authority Unitary Development Plan, 2011)[3]. This is associated with the historic settlement of Lewisham.

Known burial grounds

7.4.10 There are six known burial grounds within the baseline area. The closest burial ground is St Paul's Churchyard (HEA 44) which lies 30m to the north of the northern boundary of the site, across Coffey Street. There is however no historic mapped or other evidence to suggest that the site was ever included within the boundary of the churchyard, which is shown as separated from the site by a wall from the mid 18th century to the present day. Immediately adjoining St. Paul's Churchyard to the east is the Old Baptist Chapel burial ground (HEA 45). Two much smaller former burial grounds lie on Deptford High Street, approximately 25m to the west (the Friends burial ground; HEA 46) and approximately 95m to the southwest (the Congregational Chapel ground; HEA 47). These have been built over and are currently occupied by shops and a job centre. St. Nicholas' Churchyard (HEA 48; now disused) lies approximately 180m to the northeast of the site. An additional burial ground used by the Church of St. Nicholas (HEA 49) was also formerly located approximately 185m to the northeast of the site on McMillan Street but was built over, and is currently occupied by a block of flats.

Site location, topography and geology

7.4.11 The site lies approximately 600m to the southwest of the River Thames, and 250m to the west of Deptford Creek. The majority of the site consists of a triangular-shaped plot of open space which is currently unoccupied, apart from a north-south aligned late 19th/early 20th century brick wall (which is not statutorily or locally listed) adjacent to Deptford Church Street in the centre of the site (HEA 1B). The northwestern part of the site includes a roundabout at the junction of Coffey Street and Crossfield Street, whilst the north and southeastern parts of the site include sections of Deptford Church Street.

7.4.12 The site lies at approximately 105m ATD. There is a gradual slope downwards from north to south along Deptford Church Street, at approximately 106 m ATD to 105m ATD. The ground also slopes down very slightly down to the east, towards Deptford Creek.

7.4.13 The geology of the site comprises Kempton Park river terrace gravels. In places the terrace is overlain by brickearth (a fine grained silt believed to have accumulated by a mixture of natural processes around 17,000 years ago). Three archaeologically monitored geotechnical boreholes in the north, east and south of the site recorded 0.3m of topsoil with approximately 1.0m of modern fill and brick rubble below, overlying 1.0m to 1.3m of dark brown sandy clay soil/subsoil over the river terrace gravels 2.0 m to 2.5m below ground level (mbgl) (approximately 103.0m to 104.0m

ATD). The site topography and geology is discussed in more detail in Vol 23 Appendix E.2.

Past archaeological investigations

7.4.14 Other than the archaeological monitoring of geotechnical boreholes, no archaeological investigations have been carried out on the site in the past. A considerable number of investigations have however been carried out within the baseline area, mainly to the north and southeast of the site. Despite the number of investigations, understanding of the area prior to the later medieval period is limited; this is due to the localised nature of most of the investigations. Evidence for the post-medieval period is more abundant. Further details of past archaeological investigations carried out within the site and baseline area are included in Vol 23 Appendix E.3.

Archaeological and historical background of the site

7.4.15 The following section presents a chronological summary of the archaeological and historical background of the site. Further detail is included in Vol 23 Appendix E.4.

7.4.16 There are no known archaeological remains dated to the prehistoric period (700,000 BC–AD 43) within the site or baseline area. The site lay on dry ground in this period, and the close proximity to the Thames and Ravensbourne Rivers would have made it ideal for farming and settlement. The river terrace would have remained high and dry in relation to the nearby river systems, and soils would have developed across the gravels from the Mesolithic period onwards.

7.4.17 There are no known archaeological remains dated to the Roman period (AD 43–410) within the site and no definite remains within the baseline area. The site was probably located in open fields, some distance from nearby roads and known settlement centres, in a rural landscape of scattered farmsteads. Watling Street (HEA 38), a major Roman road, is believed to have crossed Deptford Creek approximately 250m to the southeast of the site. Outside the baseline area, excavations carried out at the junction of Deptford Church Street and The Broadway, 450m to the south of the site, revealed ditches and two burials which may be of Roman date.

7.4.18 There are no known archaeological remains dated to the medieval period (AD 410–1485) within the site or baseline area. It is likely that the site lay in open fields, perhaps used for growing crops or grazing, between the medieval settlements at Deptford Green, approximately 200m to the north of the site, and Deptford Bridge, 435m to the southwest. Early to middle Saxon pottery was found on the site of the former Deptford Power Station, 330m to the northeast of the site, whilst two 7th century burials with grave goods of jewellery were found in the vicinity of Deptford Bridge.

7.4.19 The site remained a primarily agricultural area and on the periphery of the main settlement throughout much of the post-medieval period (ie, post AD 1485). The Greater London Historic Environment Record (GLHER) records unspecified, early 19th century remains from the southwestern boundary of the site (HEA 1A). Within the surrounding baseline area, the majority of known archaeological remains date from the 17th–19th

centuries, reflecting the rapid growth of Deptford as a centre of manufacturing and industry centred on the King's Yard royal dockyard, the commercial docks and wharves on Deptford Strand and along the Ravensbourne river.

7.4.20 By the mid 18th century the eastern part of the site was occupied by a row of houses and back gardens fronting 'Church Street' (Deptford Church Street) and included the Old Roman Eagle public house, built in c. 1841 (HEA 1E). The western part of the site comprised market gardens. From the mid 19th century there was major expansion of housing and industries, partly brought about by the construction of the Deptford and Greenwich Railway in 1836 and Deptford Railway Station (HEA 6), 95m to the west of the site. A section of a viaduct (HEA 1D) passes through the southern part of the site, where the site extends along Deptford Church Street, although at this point the original arched brick bridge over the road has been replaced by a modern prefabricated concrete and steel structure, which was put in place when the road was widened to a dual carriageway.

7.4.21 By 1862, possibly earlier, a pleasure garden and associated building was laid out in the western part of the site. A rectory belonging to St. Paul's Church (both of which were constructed in c. 1717–1729), was located in the northwestern part of the site (in the area of the present roundabout). By the end of the 19th century the rectory building had been demolished, to be replaced by terrace housing, and large residential development (possibly public housing) and associated gardens had replaced the pleasure garden. These buildings were bombed during the Second World War and by the 1970s the site was cleared of all buildings other than the existing north-south brick wall through the centre of the site. The site has remained unchanged to the present day.

Statement of significance: buried heritage assets on the site

Introduction

7.4.22 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.

7.4.23 In accordance with the NPS, National Planning Policy Framework (DCLG, 2012)[4] and PPS5 Planning Practice Guide (DCLG, 2010)[5], (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

7.4.24 Archaeological survival potential across the site is generally likely to be mixed. Approximately half of the total area of the site was developed for housing during the late 19th century, and this would have caused localised ground disturbance. Historic maps show that the remaining half, comprising the back gardens and yards of these houses, has never been

built on, and here the potential for the survival of earlier remains is likely to be higher.

7.4.25 The greatest past impact to the site would have been the construction of houses in the early to late 19th century, on previously unoccupied land. If the terraced houses on the site had domestic cellars (eg, at the front along the street) these would have removed any surviving archaeological remains locally within each basement footprint. Otherwise, standard strip footings with a depth of up to 1.5mbgl would have partly or completely removed archaeological remains. Survival of remains is possible beneath and in particular between the foundations.

7.4.26 Between 1914 and 1947 the terraced houses within the southeastern part of the site were demolished and replaced with 'Bates House', a large L-shaped building with a back garden, fronting Deptford Church Street. It is not known whether the building had a basement. The impact of this construction is likely to have been similar to that described in para. 7.4.25.

7.4.27 Bomb damage during the Second World War, followed by demolition and subsequent clearance of the houses on the site, appears to have involved levelling and raising the site with the resulting rubble.

Asset potential and significance

7.4.28 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

7.4.29 The site has very low potential to contain palaeoenvironmental remains. The site lay on high, dry ground in relation to the river systems of the Thames and the Ravensbourne and with no suitable environment for the preservation of palaeoenvironmental/organic remains. Such remains, if present, would be of low asset significance, as derived from their evidential value.

Prehistoric

7.4.30 The site has low potential to contain prehistoric remains. There are no known prehistoric remains within the site or baseline area, despite a considerable number of archaeological investigations in the baseline area in the past. The closest known prehistoric artefacts to the site are located approximately 1.5km to the south. Nevertheless, the site lay on an area of high gravel, close to a major source of food, water and transport, which would have provided ideal conditions for settlement. The significance of prehistoric assets would depend on their nature, extent and condition. Isolated artefacts or features related to agriculture would be of low asset significance, evidence of settlement (if present) would be of medium or high asset significance. This would be derived from the evidential value of such remains.

Roman

7.4.31 The site has low potential to contain Roman remains. It was probably within a rural landscape of scattered farms, approximately 250m west of

the major Roman road, Watling Street. The road would have attracted activity and there may have been a small settlement where it crossed Deptford Creek, approximately 250m to the east of the site (HEA 38). The significance of Roman assets would depend on their nature, extent and condition. Isolated artefacts or features related to agriculture would be of low or medium significance. Evidence of settlement (if present) would be of medium or high asset significance. This would be derived from the evidential value of such remains.

Medieval

7.4.32 The site has a low potential to contain early and later medieval remains. The site was situated between the two settlement areas of Deptford Strand and Deptford Bridge, which had Saxon origins, and probably lay in open fields. It is considered unlikely that significant heritage assets would be discovered on the site. Isolated rural landscape features such as field drainage ditches would be of low asset significance, derived from their limited evidential and historical value.

Post-medieval

7.4.33 The site has a high potential to contain post-medieval remains. Historic maps show that the site was occupied by houses from at least as early as the mid-18th century, and that the northwestern part of the site was occupied by the Rectory of the Church of St. Paul, the footings of which may survive within the site. The building is considered to have been a highly original example of 18th century architecture, and its remains would potentially be of medium significance. The central part of the site was occupied by terraced houses, a public house, and large buildings dating from the early 19th to early 20th century. It has a high potential to preserve the footings of these buildings, along with late 19th century landscape garden features. Such remains would potentially be of low asset significance. This would be derived from the evidential and historical value of such remains.

Statement of significance: above-ground heritage assets

Introduction

7.4.34 In accordance with the NPS 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.

7.4.35 This section also describes the significance, historic character and setting of conservation areas and settings of listed buildings within the construction and operational ZTV where their historic character, appearance and settings may be affected by the proposed development. Such assets are shown in Vol 23 Figure 7.4.2 (see separate volume of figures). This figure also shows the construction and operational ZTVs and Views of Heritage Value (VHV) which illustrate important views to and from heritage assets. There are no other heritage assets in the

assessment area whose settings would be significantly adversely affected by the proposed scheme.

Within the site

St Paul's Conservation Area

7.4.36 The site lies within St. Paul's Conservation Area (which extends beyond the site into the wider assessment area), bounded by Deptford High Street in the west and Deptford Church Street in the east. There is no local authority conservation area appraisal for this conservation area. The conservation area is considered to be a heritage asset of high significance.

7.4.37 The St Paul's Conservation Area is focused on the Grade I listed St Paul's Church (HEA 50) and surrounding churchyard with its boundary wall. This is illustrated in Vol 23 Plate 7.4.1. Beyond the churchyard, to the south is the open space south of Coffey Street (in which the proposed site is located), bounded to the south by Crossfield Street and on the other side of this street, the undesignated St Joseph's Roman Catholic Primary School, and the Grade II London and Greenwich Railway viaduct, just outside the conservation area and partly screened from it by workshops and yards. The Grade II listed remains of the Old Baptist Chapel graveyard lie to the east of the church (HEA 51). The prevalence of stock brick walling of various periods in the southern part of the conservation area creates a harmony in materials.

7.4.38 The conservation area is bounded by Deptford High Street to the west, Deptford Church Street to the east and Creek Road to the north. It lies adjacent to the Deptford High Street Conservation Area to the west and south. The setting of the St Paul's Conservation Area on its west side, the far side of Deptford Church Street, is characterised by mid-20th century social housing, which makes no contribution to its significance. Views into the part of St Paul's Conservation Area where the site is located include those from Deptford Church Street and from the passage leading to St Paul's Church from Deptford High Street. This is illustrated in Viewpoint 1.1 detailed in Section 11 Townscape and visual assessment.

7.4.39 The main contribution of the site to the significance of the conservation area is that it affords views towards other heritage assets from and across its open space. The open space is not, however, historic as it was formerly built up, with housing and industry. It places the church and other nearby assets out of their historic context, but reveals the quality of their architecture. The quality of the space is poor and neglected and the space is bisected by a wall which is essentially out of its historic context. These aspects detract from the character of the conservation area. However, the space enables clear views of St Paul's Church from the open space. The presence of an open space on the site therefore makes a moderate contribution to the significance of the conservation area

Vol 23 Plate 7.4.1 Historic environment – St Paul's Conservation Area: view west across the site towards St Paul's Church along Coffey Street

Remnant brick wall and cobbles

7.4.40 The site includes a number of remnant heritage features, ie, the brick wall (HEA 1B) and associated cobbles and kerbing (HEA 1C) on Crossfield Street, illustrated in Vol 23 Plate 7.4.4. These features represent remaining elements of the development that stood on this site until it was removed following bomb damage in the Second World War, after which the area was left undeveloped as an open space. This part of the conservation area is largely open and characterised by green space and mature trees, partly enclosed by the structures to the south, whilst the area to the north of the church is characterised by dense residential housing.

7.4.41 The brick wall (HEA 1B) that runs across the centre of the site appears to date from the late 19th or early 20th century. Its materials harmonise with those of the walling nearby. It is likely to have originally formed the boundary of the late 19th century housing that occupied the centre of the site (illustrated in Vol 23 Appendix E.5, Vol 23 Plate E.3) and separated it from the terraced housing fronting onto Deptford Church Street and the industrial building that replaced part of this housing. The wall is not statutorily or locally listed and is a heritage asset of low significance, derived from its historical, evidential and aesthetic value.

7.4.42 To the west of the brick wall, the gardens were redeveloped by the 1890s and a series of houses, later known as Rectory Buildings, were built around the original 'L' shaped form of Coffey Street. The original cobbled surface (HEA 1C) at the southern entrance from the site to a lane behind

the Rectory Buildings, as well as the kerbed former southern entrance, are still visible leading off Crossfield Street (formerly Crossfield Lane). The cobbled surface and kerb relate to the adjacent surviving 19th century buildings and are assets of low significance, derived from historical, evidential and aesthetic value.

Within the assessment area

St Paul's Church

7.4.43 The Grade I listed Church of St Paul (HEA 50), Deptford Church Street, lies 30m from the northern edge of the site. The listing description states that it is an outstanding early 18th century English Baroque parish church and one of the finest achievements of the architect Thomas Archer. The raised body of the church over the crypt is an unusual arrangement and, as the freestanding building is situated within a large graveyard, the powerful design of each elevation is evident. It is well preserved with a well restored interior with 18th-century plasterwork. The building is considered to be a heritage asset of high significance due to its evidential, historical, aesthetic and communal values. Its churchyard's high southern boundary walling displays evidence of various periods of construction. The stretch of walling around its south gate is relatively recent and is of less significance than its more historic parts.

7.4.44 Its setting strongly contributes to the significance of the church as a historic structure designed to be prominent within the surrounding townscape. Although partly screened by mature trees, the main body of the church and its pointed spire form a prominent feature within the area, and are clearly visible in views along the road leading off Deptford High Street and along Deptford Church Street. This is illustrated by View of Heritage Value 1 in Vol 23 Figure 7.4.2 (see separate volume of figures) and Viewpoint 1.1 detailed in Section 11 of this volume. The principal elevation of the church is on the west side, aligned with views along the passage leading from Deptford High Street, illustrated in Vol 23 Plate 7.4.1. There are also views to the church from the south and east; however the fact that there were historically buildings in this area, until the late 20th century, means that the church was not historically designed to be as prominent in these views, so they are of less significance to its setting than the more historic views.

7.4.45 The setting of the church itself includes the surrounding churchyard and wall, and the open space of the site to the south, which, although not a historic feature of the area, serve to frame views to the church from the southeast. This is shown in Viewpoints 3.1 and 1.4 detailed in Section 11 of this volume. Parts of St Paul's churchyard are characterised by their relative tranquillity in comparison with the surrounding main roads to the east and west of the site. Generally, there are only very limited views of the open space to the south from within the churchyard and the high churchyard walls were intended to create a visual and noise barrier and barrier in character between the churchyard and the surrounding housing and industry of Deptford. The fact that there is an open space to the south and west of the site, means that the churchyard wall, and to an extent the church itself, are out of their historic context, which has included buildings,

(including first a rectory, in the early 18th century and later housing from the late 18th century) until the late 20th century, and the site therefore contributes very minimally to the character of the wall, churchyard, and the church in this respect. However, for the church's early history parts of this area were open gardens and the presence of the space affords long relatively unimpeded views of the church, which better reveal the architecture of the church and thus makes a positive contribution to its significance.

7.4.46 The existing setting of St Paul's Church, to the south beyond its graveyard boundary walls, has an openness, the character of which is relatively recent and a result of historic loss in the latter part of the 20th century, rather than planned design. Historic maps and the presence of the brick wall that lies across the site indicate that the area was densely occupied by housing and industry before the Second World War. The loss of the buildings and creation of the existing open space following the Second World War created a far more open setting than previously existed. This means the church is now more prominent within the townscape than it was before the Second World War. Whilst the brick wall (HEA 1B) and kerbing along Crossfield Street (HEA 1C) contribute to the historic character of the St Paul's Church Conservation Area and setting of St Paul's Church, the quality of the open space itself is poor and ill-defined with random tree planting. This is shown in Vol 23 Plate 7.4.2 and Vol 23 Plate 7.4.3. The setting of the church on this side therefore makes only a minor contribution to its significance, mainly by revealing a prominent view of the listed building which has acquired some communal and aesthetic value in recent years, although it is at variance with the historically far more dense urban landscape within which the church had sat for over hundred years. In heritage terms the site contributes little to the significance of the church, other than allowing the architecture to be viewed at a greater distance than was possible until the Second World War.

Vol 23 Plate 7.4.2 Historic environment – view north from within the site towards St Paul's Church across the site

Vol 23 Plate 7.4.3 Historic environment – view east along Coffey Street from the west, with the walls of the graveyard to St Paul's Church to the north (left of plate) and site to the south (right of plate)

Walls and railings to the north and east of St Paul's Church

7.4.47 Listed separately, are the wall and railings (HEA 52) to the north and east of St Paul's churchyard, which are Grade II listed. The wall is early 18th century in date whilst the railings and gate are 19th century. They are assets of high significance due to their evidential, historical and aesthetic value. Their setting includes St Paul's Church and graveyard to the south and west, and the residential area to the north. In general, setting makes a moderate contribution to the significance of the asset, as it retains its historic character, except to the west, where its historic character is largely altered, although there are longer views of the walls than there were historically. The site has little contribution to the setting of this asset, which was erected in more densely built townscape.

Vol 23 Plate 7.4.4 Historic environment – view from the centre of the site to the northeast across the site towards the post 1894 brick wall to right and wall of the churchyard to left

Remains of Old Baptist Chapel

7.4.48 The surviving walls (HEA 51) of the former graveyard to the Old Baptist Chapel (demolished), on the opposite side of Coffey Street, which runs along the northern edge of the site, are Grade II listed. They are of 18th century stock brick, with a stone coping in some areas and buttress piers. Some 19th century repairs are evident. The walls constitute a heritage asset of high significance, due to their evidential, historical and aesthetic value. Their setting is characterised by the presence of St Paul's Church and surrounding graveyard wall to the west and the open ground including Coffey Street and the site to the south. In general, setting makes a moderate contribution to the significance of the asset, as the churchyard is extant, although the space to the west and south west is including the site

is much altered, and makes less contribution to its significance, despite providing longer views of the wall.

London and Greenwich Railway viaduct

7.4.49 The railway viaduct (HEA 1D) running across the southern tip of the site forms a part of the North Kent to Deptford Creek section of the London and Greenwich Railway and was opened in 1836. The Grade II listed viaduct carried the first passenger railway in London and is considered to be one of the first major achievements of railway engineering in Britain. The 5.2km-long viaduct of grey brick includes 32 arches spanning a stretch from Deptford Creek to Deptford Church Street, and 30 arches spanning from Deptford Church Street to Deptford High Street. It is therefore considered a heritage asset of high significance due to its evidential, historical, aesthetic and communal value.

7.4.50 However, the section of the viaduct which crosses the south eastern corner of the site over Deptford Church Street comprises a modern prefabricated concrete and steel deck that replaced the original arched brick bridge. This component is not referred to in the statutory listing description, and is of low significance. The more historic part of the viaduct, south of the site boundary, between Deptford Church Street and Deptford High Street has workshops and yards built against its north side. These detract from its setting and provide a barrier between the site and the viaduct. The contribution of the viaduct's immediate setting, including the site, to its significance is therefore low. There are views from the vantage point of the viaduct of St Paul's Church, over the site, which were historically more restricted when there was housing and industrial buildings on the site before the site became an open space. The views of St Paul's Church contribute moderately to the setting of the viaduct, but the contribution of the open space of the site to the significance of the viaduct is low.

St Joseph's Roman Catholic School

7.4.51 St Joseph's Roman Catholic Primary School is a late 19th century purpose built school building, with a playground to the fore surrounded by a high brick wall. It is undesignated and a heritage asset of low significance. The open space and St Paul's Church form part of its setting. However, the contribution of its setting to its significance is low due to the proximity of walls and structures. The site therefore makes little contribution to its setting.

Deptford High Street Conservation Area

7.4.52 Deptford High Street Conservation Area, a heritage asset of high significance, lies to the east of the site. It is largely linear, inward-looking with views focused on the building frontages along the high street. This is illustrated by View of Heritage Value 3 as illustrated in Vol 23 Figure 7.4.2 (see separate volume of figures). It includes the listed railway viaduct beyond the southern edge of the site, which forms a visual barrier which divides the conservation area to the north and south. There is a visual relationship between St Paul's Church and St Paul's Conservation Area and the railway viaduct over the site. The views would have been more

restricted historically. Other than the railway viaduct, the main part of the conservation area's setting is characterised by the rear aspects of the buildings on Deptford Church Street and their back yards. Views between the site and the main part of the conservation area are restricted to those along the passage leading off Deptford High Street to St Paul's Church. This is illustrated by View of Heritage Value 2. The contribution of the area of the site to the setting to the significance of the Deptford High Street Conservation Area is generally low.

Creekside Conservation Area

7.4.53 Creekside Conservation Area, a heritage asset of high significance, has two distinct characters. The railway viaduct bisects the conservation area from east to west. The eastern part of the area to the south is characterised by a relatively intact industrial and warehouse area, the only surviving industrial area of some coherence on Deptford Creek. The area to the north, and the western part of the southern portion of the conservation area, is occupied by the Crossfield Estate, a typical 1930s London County Council estate that became a centre of the radical arts music scene in the 1970s and 1980s. The site makes little contribution to the setting of the Crossfield Estate, other than as an open amenity space and as a space over which there are views of St Paul's Church, from the estate's buildings. However, when the estate was built the site was already built up, so these elements of the Conservation Area's setting play little role on its historic character. Deptford Church Street and its traffic dominate the western boundary of the conservation area.

Construction base case

7.4.54 As described in para. 7.3.12, future baseline conditions for buried assets are not anticipated to change within or surrounding the site. This is also the case for statutorily designated heritage assets affected by ground movement (7.3.13). Similarly, the base case for the setting of heritage assets is not anticipated to change (para. 7.3.14).

Operational base case

7.4.55 The development on the opposite side of the viaduct in Giffin Street would change the setting of the viaduct but this would be entirely screened from the site by modern additions to the viaduct.

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, construction of permanent above-ground ventilation structures and landscaping

7.5.2 Ground disturbance associated with the demolition of a brick wall, site stripping, the construction of the works compound, the diversion or removal of existing service trenches, construction of the electrical and control kiosk and ventilation columns, and landscaping within the site, to a maximum depth of approximately 1.5mbgl, as assumed for the purposes of this assessment, would potentially truncate archaeological remains. These works would have a localised impact on surviving post-medieval archaeological remains (eg, footings of 18th and 19th century domestic buildings), of low asset significance. There would be no impact on the possible buried remains associated with the 18th century rectory, as this falls outside the area of proposed landscaping. Effects on earlier archaeological resources are not anticipated due to the shallow depth of these works. Given the localised nature, these works would comprise a low level of impact on these assets of low significance, reducing asset significance to negligible and resulting in a **minor adverse** effect.

Construction of the CSO drop shaft and other permanent below-ground structures

7.5.3 Deep ground disturbance for the CSO drop shaft and associated below ground structures would entirely remove any archaeological remains present from within the footprint of each construction. Construction of the interception and valve chambers, ventilation structure and ventilation ducts would be deep enough to heavily truncate or entirely remove any archaeological remains present. These works would constitute a high magnitude of impact, reducing asset significance to negligible. The environmental effect of these works would vary depending upon the significance of the assets removed:

a. There is a very low potential for palaeoenvironmental remains of low asset significance. The removal of such remains would constitute a **minor adverse** effect.

b. There is a low potential for possible, previously unrecorded prehistoric and Roman remains. Remains of isolated, redeposited artefacts would be of low asset significance, and the removal of such remains would constitute a **minor adverse** effect. *In situ* remains would be of medium to high asset significance, depending on their nature and extent, and their removal would comprise a **moderate** or **major adverse** effect, if present.

c. There is a low potential for remains of early and later medieval agricultural activity of low asset significance. The removal of such remains would constitute a **minor adverse** effect.

d. There is a high potential for post-medieval remains, in the form of footings of 19th century domestic buildings and landscape features of low asset significance. The removal of such remains would constitute a **minor adverse** effect. There would be no impact on the possible buried remains associated with the 18th century rectory.

Above-ground heritage assets

Physical effects on above-ground heritage assets

7.5.4 The extant late 19th/early 20th century brick wall (HEA 1B) which crosses the centre of the site from north to south would be removed during the associated development works. The physical removal of the wall would comprise a high magnitude of impact upon this heritage asset of low significance, and would constitute a **minor adverse** effect.

7.5.5 The 19th century cobbled and kerbed entrance (HEA 1C) into the site, of low asset significance, would be likely to be removed during the construction works. Partial or complete physical removal would comprise a high magnitude impact, constituting a **minor adverse** effect.

7.5.6 There would be an effect resulting from ground movement on Grade I listed St Paul's Church (HEA 57) and its boundary walls. The building would experience settlement of between 1mm and 3mm, with the greatest settlement at its western (tower) end and to the western stretch of the boundary walls. The building damage assessment considers the damage risk category to be negligible with the possibility of hairline cracks typically up to 0.1mm in width. Although there are fragile and important decorative elements within the church, it is considered that with a negligible damage risk, the magnitude of change, given the high significance of the church, would be low. This would constitute a **minor adverse** effect on the church and its surrounding walls.

7.5.7 The Grade II listed London to Greenwich Railway viaduct (HEA 1D), a section of which passes over the southern edge of the site, has also been assessed for ground movement effects. The viaduct would experience a maximum settlement of 6mm. The damage assessment predicts the damage risk to be negligible, with the possibility of hairline cracks of a typical maximum width of 0.1mm. There would be no impact upon the structural integrity of the viaduct. The magnitude of change to this asset of high significance is negligible, and therefore there would be a **minor adverse** effect as a result of ground movement.

Effects on historic character and setting of above-ground heritage assets

7.5.8 The NPS recognises in paragraph 1.4.4 that nationally significant infrastructure projects are likely to take place in mature urban environments, with adverse construction effects on historic environment receptors likely to arise. Construction works similar to those proposed are commonplace in 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, as assessed, relate to the peak construction phase. Effects during other phases of works are likely to be lower due to reduced levels of plant being required and a reduced intensity of construction activity.

Character and appearance of St Paul's Conservation Area

7.5.9 The construction phase would require the installation of hoarding, cranes, a piling rig and other construction plant. This would obstruct views

towards St Paul's Church and its surrounding associated heritage assets from the south and southeast. Although these views would have been considerably more restricted historically, they contribute moderately to the character of the conservation area. The positioning of the cranes would also detract from more distant views to the church spire. However, the church and its associated assets would still be clearly visible from the most significant surviving historic view, that from the passage leading from Deptford High Street towards the church's principal elevation, and also from Deptford Church Street, illustrated by View of Heritage Value 2 (see Vol 23 Figure 7.4.2 in separate volume of figures) and Viewpoint 1.1 detailed in Section 11 of this volume. The high churchyard wall was designed as a barrier to the surrounding housing and industry and the wall and the presence of mature trees within the graveyard would serve to screen construction activities, reducing the effect of the construction works. The magnitude of change in relation to the historic character of the St Paul's Church Conservation Area would therefore be medium, resulting in a **moderate adverse** effect.

Setting of St Paul's Church

7.5.10 The construction works, notably the presence of cranes, would partly detract from views towards St Paul's Church from the south and south west, and visually compete with the dominance of the church spire within the surrounding townscape. The increased noise (see Section 9 of this volume, where a significant adverse effect is predicted on St Paul's Church during construction) and construction activity would also detract from the setting. The overall magnitude of change would be tempered by the high churchyard walls, which were originally designed as a barrier between the church and the surrounding urban activity, thus resulting in a medium magnitude of change to the setting of St Paul's Church. The significance of the effect would be **moderate adverse**. It should be noted that the separate townscape and visual assessment (Section 11) concludes that the works would have a major adverse effect upon the church. The difference between the two assessments derives from their different methodologies: one considers the effect of the change to the whole setting of the church and its effect on the church's heritage value; whereas the other uses a representative view of the church to illustrate the effect upon views, and includes non-heritage factors.

Setting of St Joseph's Roman Catholic School

7.5.11 Although the site makes little contribution to the significance of St Joseph's Roman Catholic School, the construction works would detract from southward views towards it. The magnitude of change in relation to its setting would therefore be low, resulting in a **minor adverse** effect.

Setting of London and Greenwich Railway viaduct

7.5.12 The construction works would detract from the views of and from the London and Greenwich Railway viaduct, including the kinetic view towards St Paul's Church. However the height of the top of the viaduct would mean that there would still be substantial views of the church. The magnitude of change in relation to the viaduct's setting would be negligible due to the presence of intervening workshops and the high level of views

between the church and the top of the viaduct, which would not be impeded by most of the construction activity, resulting in a **minor adverse** effect.

Setting of Deptford High Street Conservation Area

7.5.13 The construction works would largely be screened from the Deptford High Street Conservation Area by the presence of intervening buildings, except for the listed viaduct. Although the cranes may be visible at certain points rising above the building frontages, the magnitude of change in relation of the setting of the Deptford High Street Conservation Area, an asset of high significance, would be negligible, resulting in a **minor adverse** effect

Setting of Deptford Creekside Conservation Area

7.5.14 The construction works would be visible from the Crossfield Estate, although not from the Creekside industrial area. They would detract little from the character and appearance of the conservation area, as much of the estate and the bulk of the conservation area lies south of the railway viaduct, and the road and traffic would still dominate the estate's western boundary, and the nearest blocks are set back from the road frontage. The magnitude of change in relation of the setting of the Deptford Creekside Conservation Area, an asset of high significance, would be low overall. The construction works at Greenwich Pumping Station would affect the eastern part of the conservation area. Its industrial character is fairly robust, and cranes and construction activity would not be out of place in an industrial setting. There would therefore be a low magnitude of change to the setting of the industrial part of the conservation area from the construction at Greenwich Pumping Station. There would be negligible change to the setting of the Crossfield Estate, and the railway viaduct would provide a visual barrier between the Greenwich Pumping Station site and the part of the Crossfield Estate nearest to the Deptford Church Street site.

7.5.15 Overall the effect on the Creekside Conservation Area would be **minor adverse**.

Sensitivity test for programme delay

7.5.16 For the assessment of historic environment 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. The Griffin Street Regeneration Area would be complete but the Deptford Creek area would otherwise subject to ongoing and long term change with a number of schemes identified in the development schedule. These are, however, some distance away and screened from the site.

7.6 Operational effects assessment

Above-ground heritage assets

Effects on the historic character and setting of above-ground heritage assets

Character and appearance of St Paul's Church Conservation Area

7.6.1 The post-late 19th century boundary wall would be removed (HEA 1B, 1C) which would lessen the number of stock brick walls in this part of the conservation area, which would have an adverse effect on the character of the conservation area. However, overall the operational phase would enhance the character of the St Paul's Conservation Area by improving the condition and quality of design of the open space. The more unified and comprehensive open space would integrate two distinct parts of the conservation area. The main contribution of the site to the character of the conservation area is the views across and over the open space of the site, and the operational phase would further open up of views between and of the most significant heritage assets in the conservation area, which would be a benefit. The improved planting, amenity value and integration between the open space and the Churchyard would attract more footfall and would therefore improve public access and public appreciation of the significance of the Church as the centre of the conservation area, reintegrating the conservation area's disparate elements. The improved character of the space would also make reference to the historic rectory's gardens, which occupied part of the site. In terms of the historic character of the St Paul's Church Conservation Area, the magnitude of change would be medium beneficial, resulting in a **moderate beneficial** effect.

7.6.2 It should be noted that the separate townscape and visual assessment (Section 11) concludes that the works would have a minor beneficial effect upon the conservation area. The difference between the two assessments derives from their different methodologies: one considers the effect of the change on the heritage value of the conservation area, which would be enhanced by the improved setting of the church and the enhancement of the character of the open ground at the south end of the conservation area; whereas the other mainly considers the effect upon the townscape character of the area as a whole, and includes non-heritage factors.

Setting of St Paul's Church

7.6.3 The scale of planting within the site and presence of the ventilation columns would not detract from views towards St Paul's Church and its surrounding wall, as the columns would be relatively low and slender. The church, part screened by mature trees, and its spire would retain their prominent position in the townscape. The introduction of the ventilation columns within the site would form part of the overall streetscape without introducing discordant elements. The ventilation columns within the open space would form an integral part of the overall design and would not detract from the setting of the church and its surrounding wall. The better quality of the open space and integration between the open space and the Churchyard would attract more footfall and would therefore improve public

access and public appreciation of the significance of the Church as the centre of the conservation area, reintegrating the conservation area's disparate elements. The surviving historic significance of the original design concept of the church would remain intact. The magnitude of beneficial change in relation to the setting of St Paul's Church would therefore be medium, resulting in a **moderate beneficial** effect.

7.6.4 It should be noted that the separate townscape and visual assessment (section 11) concludes that the works would have a minor beneficial effect upon the church. The difference between the two assessments derives from their different methodologies: one considers the effect of the change to setting upon the heritage value of the church, which would be enhanced through improved views and landscaping, referring to the former rectory's gardens that occupied part of the site, and allowing heightened appreciation of the significance of the listed building; whereas the other is based on effects to a representative view of the church to illustrate the effect upon visual amenity, and includes non-heritage factors.

Setting of St Joseph's Roman Catholic School

7.6.5 Although the role of the site in the setting of the St Joseph's Roman Catholic Primary School is limited, the proposed development would enhance its setting to some extent. The magnitude of change in relation to its setting would therefore be low, resulting in a **minor beneficial** effect.

Setting of London and Greenwich Railway viaduct

7.6.6 The proposed development would enhance the setting of the London and Greenwich Railway viaduct by improving the quality of design of the adjacent green space and improving the quality of the foreground of the high level views between the viaduct and St Paul's Church. The magnitude of change in relation to its setting would however be low due to the intervening presence of small work units, resulting in a **minor beneficial** effect.

Setting of Deptford High Street Conservation Area

7.6.7 The Deptford High Street Conservation Area would be screened from the operational phase by the presence of intervening buildings. However, the proposed development and landscaping would enhance views along the passage from Deptford High Street leading to St Paul's Church and the eastern approach to the conservation area from Crossfield Street. The effects on the setting of the railway viaduct within the conservation area are as stated in para. 7.6.6 above. The magnitude of change in relation to its setting would therefore be low, resulting in a **minor beneficial** effect

Setting of Deptford Creekside Conservation Area

7.6.8 The open space to the west of the Crossfield Estate would be improved. However Deptford Church Street's traffic would still dominate the conservation area's boundary. The magnitude of change in relation to its setting would therefore be low, resulting in a minor beneficial effect. As with the construction phase, there would be no elevated effects on the conservation area during the operational phase, from the Greenwich

Pumping Station and Deptford Church Street sites together, as they affect different parts and different aspects of the conservation area.

Sensitivity test for programme delay

7.6.6 For the assessment of historic environment 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. The Giffin Street Regeneration Area scheme would be complete but the Deptford Creek area is subject to ongoing and long term change with a number of schemes identified in the development schedule but these are some distance away and screened from the site.

7.7 Cumulative effects assessment

7.7.1 During the Thames Tideway Tunnel project construction phase, the Giffin Street Regeneration Area would be under construction. This includes proposals to develop an area of on waste ground to the south of the St Paul's Conservation Area, to the east of the Deptford High Street Conservation Area and to the south of the listed viaduct. The development would only affect the viaduct and would not lead to elevated effects on the setting of the viaduct during construction because the affected part of the viaduct is largely made of modern fabric and is screened from the site by intervening buildings.

Sensitivity test for programme delay

7.7.2 For the assessment of historic environment cumulative effects during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not elevate effects or be likely to materially change the assessment findings reported above. The Giffin Street Regeneration Area scheme would be complete and so form part of the base case. While there are a number of schemes identified in the development schedule, these are some distance away and screened from the site.

7.7.2 As the majority of the schemes detailed in the development schedule (Vol 23 Appendix N) would be complete and operational by the operational phase assessment year, no cumulative effects are anticipated on the historic character and setting of above-ground heritage assets.

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.

Construction

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 site preparation and construction to mitigate impacts upon remains of low asset significance (eg, footings of 18th century and later domestic buildings).

b. A targeted archaeological excavation and recording of any more significant remains (carried out in advance of construction), if their presence is revealed by preliminary site based field evaluation (although there is a low probability of this being required based on the desk-based assessment).

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 St Paul's Church (HEA 57) would be monitored during construction to ensure that movement is within predicted limits. If exceeded, measures would be implemented in accordance with the *CoCP* (Section 12). Any significant damage would be repaired following construction using appropriate conservation techniques to achieve a like for like repair. The London and Greenwich Railway viaduct (HEA 1D) would also be monitored during construction and measures similarly implemented.

7.8.7 The mitigation for the minor adverse effect resulting from the removal of the late 19th/early 20th century wall (HEA 1B) and the 19th century cobbled surface (HEA 1C) within the site would comprise an English Heritage Level 1 basic archaeological visual record[6].

7.8.8 All measures embedded in the proposed development and *CoCP* of relevance to the assessment of effects on the character and setting of above-ground heritage assets during construction are summarised in Section 7.2. Beyond these measures, no mitigation during construction is possible for significant adverse effects due to the highly visible nature of the construction activities. Mitigation measures for noise effects on St Paul's Church are detailed in Section 9 Noise and vibration.

Operation

7.8.9 Since no adverse effects on the historic character, appearance and setting of above-ground heritage assets during operation have been predicted, no mitigation is required.

7.9 Residual effects assessment

Construction effects

7.9.1 There would be **negligible** residual construction effects on buried heritage assets. All residual effects are presented in Section 7.10.

7.9.2 With the proposed mitigation measures, the residual construction effects on St Paul's Church, the London and Greenwich Railway viaduct, and the late 19th/early 20th century wall and cobbled surface would be **negligible**.

7.9.3 As no mitigation measures are required further to those embedded within the proposed design, design principles and CoCP for minor adverse effects on the character and setting of above-ground heritage assets or proposed for significant adverse effects, the residual construction effects on the setting of heritage assets remain as described in Section 7.5. All residual effects are presented in Section 7.10.

Operational effects

7.9.4 As no mitigation measures are required further to those embedded within the proposed design and environmental design principles for effects on the character and setting of above-ground heritage assets, the residual operational effects on the setting of heritage assets remain as described in Section 7.6. All residual effects are presented in Section 7.10.

7.10 Assessment summary

Vol 23 Table 7.10.1 Historic environment – summary of construction assessment

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
Buried heritage assets				
Very low potential for palaeoenvironmental remains (Low asset significance)	Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures. Asset significance reduced to negligible.	Minor adverse	Targeted archaeological investigation and recording, including environmental sampling.	Negligible
Low potential for previously unrecorded prehistoric and Roman remains (Low to high asset significance, if present, depending on nature and preservation)	Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures. Asset significance reduced to negligible.	Minor to major adverse, depending on asset type and significance	Targeted archaeological investigation and recording.	Negligible
Low potential for medieval agricultural remains (Low asset significance)	Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures. Asset significance reduced to negligible.	Minor adverse	Targeted archaeological investigation and recording.	Negligible
High potential for buried post-medieval remains of 18th and 19th century houses (Low asset significance)	Assets removed by demolition, site setup, construction of permanent above-ground ventilation structures and landscaping. Asset significance reduced to negligible.	Minor adverse	Archaeological watching brief.	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	Assets removed by excavation for the CSO drop shaft, and other permanent below-ground structures. Asset significance reduced to negligible.	Minor adverse	Archaeological watching brief.	Negligible
Above-ground heritage assets				
Late 19th/early 20th century brick wall running through centre of the site (Low asset significance)	The wall would be permanently removed from the site (a high magnitude of impact). Asset significance reduced to negligible.	Minor adverse	English Heritage Level 1 visual record.	Negligible
19th century cobbled and kerbed entrance into the site (Low asset significance)	This would be partially removed from within the footprint of the permanent works within the site. Asset significance reduced to negligible.	Minor adverse	English Heritage Level 1 building recording.	Negligible
Modern concrete deck replacement section of Grade II listed London and Greenwich Railway Viaduct within site (Negligible significance)	The asset would not be physically affected by the construction works.	Negligible	None.	Negligible
St Paul's Conservation Area (High asset significance)	The construction works would have a medium magnitude of impact and detract from the historic character of the conservation area.	Moderate adverse	No mitigation possible further to that embodied within the proposed design and the *CoCP* and environmental design principles.	Moderate adverse
St Paul's Church (High asset significance)	Ground movement resulting from construction works, with predicted	Minor adverse	The building would be monitored throughout the	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	negligible damage risk (typically hairline cracks up to 0.1mm in width), with a low magnitude of change.		works, and any significant damage repaired following the completion of the works using appropriate conservation techniques to achieve like for like repair.	
	The construction works would detract from setting of St Paul's Church giving rise to a medium magnitude of impact	Moderate adverse	No mitigation possible further to that embodied within the proposed design and the *CoCP* and environmental design principles.	Moderate adverse
St Joseph's Roman Catholic School (Low asset significance)	The construction works would have a medium magnitude of impact on the setting of the building.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and environmental design principles.	Minor adverse
London and Greenwich Railway viaduct (High asset significance)	Effects of ground movement during construction, with predicted negligible damage risk (typically hairline cracks up to 0.1mm in width), with a low magnitude of change.	Minor adverse	The structure would be monitored during construction, and any significant damage repaired following the completion of the works using appropriate conservation techniques to achieve like for like repair.	Negligible
	The construction works would have	Minor adverse	No mitigation required	Minor adverse

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	a low magnitude of change to the setting of the structure.		further to that embodied within the proposed design and the *CoCP* and environmental design principles.	
Deptford High Street Conservation Area (High asset significance)	The construction works would have a low impact on the setting of the Conservation Area by affecting views along the passage leading from Deptford High Street.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and environmental design principles.	Minor adverse
Deptford Creekside Conservation Area	The construction works would have a low impact on the setting of the Conservation Area by affecting views along the passage leading from Deptford High Street.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and environmental design principles.	Minor adverse

Vol 23 Table 7.10.2 Historic environment – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
St Paul's Conservation Area (High asset significance)	The proposed development would enhance the character and appearance of the conservation area, by improving the southern part of the conservation area, introducing references to the presence of historic gardens in part of the site and changes to the setting of St. Paul's Church.	Moderate beneficial	None	Moderate beneficial
St Paul's Church (High asset significance)	The proposed development would enhance the setting of the church, including through maintaining an improving views of the church from the south, and referencing former gardens that were in part of the site a medium magnitude of change.	Moderate beneficial	None	Moderate beneficial
St Joseph's Catholic Primary School (Low asset significance)	The proposed development would enhance the setting of the building. Improving the quality of the nearby open space and better integrating the building with the church. .	Minor beneficial	None	Minor beneficial
London and Greenwich Railway Viaduct (High asset significance)	The proposed development would have a low magnitude of change, beneficial effect on the setting of the viaduct, improving views of St Paul's Church over the gardens and of the viaduct from Coffey Street.	Minor beneficial	None	Minor beneficial
Deptford High Street	The proposed development would	Minor	None	Minor beneficial

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Conservation Area	have a low beneficial magnitude of change on the setting of the conservation area, by improving its eastern approach	beneficial		
Deptford Creekside Conservation Area	The proposed development would have a low beneficial magnitude of change on the setting of the conservation area, by improving the nearby open space.	Minor beneficial	None	Minor beneficial

References

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

[2] *Deptford High Street St Paul's Conservation Areas Appraisal.* Available at: http://www.lewisham.gov.uk/Environment/Planning/ConservationAndUrbanDesign/ConservationAreas/DeptfordHighStreetStPaulsConservationAreas.htm. Accessed 10 May 2011.

[3] *Lewisham Local Authority Unitary Development Plan*. Available at: http://www2.lewisham.gov.uk/lbl/planning/udp/schedule3.html. Accessed 10 May 2011.

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

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

[6] English Heritage. *Understanding historic buildings: a guide to good recording practice.* Swindon (2006).

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 8: Land quality

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Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 23: Deptford Church Street 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 Deptford Church Street 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 the 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 controlled waters 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[i] 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 air quality and odour sources, 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

[i] 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, Vol 2 Table 8.3.1). 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 23 Deptford Church Street 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. combined sewer overflow (CSO) drop shaft (online), the invert of which would be located at a depth of approximately 48m below ground level (bgl), located within the Chalk

b. interception chamber, culvert and valve chamber, CSO overflow structures and other hydraulic structures

c. air management equipment including ventilation columns, filters, ducts and air treatment chambers

8.2.3 Internal dewatering within the proposed diaphragm wall at the constructed drop shaft would be required within the Thanet Sand/Chalk.

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 In addition to the above, there would also be a minor amount of highway work at four discrete points located along Deptford Church Street.

8.2.6 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 the Deptford Church Street site construction plans - see separate volume of figures).

Code of Construction Practice

8.2.7 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* Section 9 for full details.

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

8.2.9 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

8.2.10 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 Part A*):

a. completion of a desk study which includes a review of available information sources (see Vol 23 Appendix F.1) and production of an initial conceptual site model

b. specialist site surveys, such as Japanese Knotweed and UXO, which to date has included a site-specific desk study for part of the Deptford Church Street site to inform ground investigation work (see Vol 23 Appendix F.2)

c. drilling of boreholes and assessment of soil and groundwater quality.

8.2.11 In addition to the above, land quality would continue to be assessed via the following measures:

a. preparation of a preliminary risk assessment, design of a ground investigation rationale and additional ground investigation surveys which would include construction of exploratory test holes (such as boreholes), collection of soil and water samples for laboratory chemical testing and environmental monitoring (such as soil gas and soil vapour). A phased approach would be applied to ground investigation, with additional, detailed phases of investigation implemented as necessary to supplement, target and refine the findings and conclusions of the earlier assessments

b. site-specific land quality risk assessments would identify the need for specific remediation measures. Where necessary, the risk assessment would also be used to provide re-use or import criteria for soil material to be permanently placed at the site.

8.2.12 Where the site-specific land quality risk assessment identifies the need, a site-specific remediation strategy would be produced and implemented, including:

a. remedial options appraisal (as required)

b. details of the remediation strategy and methodology

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

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

Construction

8.2.13 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, additional risk assessments would be undertaken and additional control measures implemented prior to any works recommencing.

8.2.14 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*).

8.2.15 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 The *Scoping Report* was prepared before the Deptford Church Street site had been identified as a preferred site. The scope for the assessment of land quality at this site is therefore based on professional judgement as well as experience of similar sites.

8.3.3 The LB of Lewisham were specifically consulted with respect to any land quality data they hold at the site and surrounding area, however the LB of

Lewisham held no data pertinent to land quality and as such a search was undertaken of the LB of Lewisham planning website.

Baseline

8.3.4 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

8.3.5 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.

8.3.6 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.

8.3.7 The construction assessment has been undertaken for Site Year 1 of the construction phase.

8.3.8 The base case and cumulative assessment in Site Year 1 of construction take into account the schemes described in Vol 23 Appendix N. The baseline is not anticipated to change substantially between the baseline and Site Year 1 of construction (2016). There are no proposed developments within the 250m buffer area which are likely to be complete and operational before the commencement of the construction.

8.3.9 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 developments are included within the cumulative effect assessment and are identified in Vol 23 Table 8.3.1.

Vol 23 Table 8.3.1 Land quality – construction base case and cumulative assessment development (2016)

Development	Distance from site	Construction base case	Cumulative impact assessment
Giffin Street Regeneration Area, Giffin Street (alterations and change of use from a business centre to educational facility and redevelopment of a car park to a multipurpose use including primary school, games area, library, residential properties and commercial floorspace)	50m south	✗	✓
Creekside Village East (Thanet Wharf), Copperas Street (demolition of buildings and construction of	220m northeast	✗	✓

Development	Distance from site	Construction base case	Cumulative impact assessment
commercial floorspace, nursery, healthcare centre and residential units with associated landscaping)			

Symbols ✓ applies ✗ does not apply

8.3.10 Section 8.5 details the likely significant effects arising from the construction at the Deptford Church Street 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

8.3.11 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.

8.3.12 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.

8.3.13 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.

8.3.14 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.

8.3.15 The methodology for undertaking both source-pathway-receptor analysis and the impact assessment is provided in Vol 2 Section 8.

Assumptions and limitations

8.3.1 The assumptions and limitations associated with this assessment are presented in Vol 2. Assumptions and limitations specific to the site are detailed below.

Assumptions

8.3.2 A layer of Made Ground associated with previous development is likely to be present and it is assumed that this has the potential to be contaminated.

8.3.3 The approach to remediation cannot be defined at this stage due to a lack of data. It is therefore assumed that some contamination would still remain on-site 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 site).

Limitations

8.3.4 There is no site-specific data on the soil or groundwater quality available within the LLAU. It is however, considered that there is sufficient information currently available to provide a robust assessment.

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 used in this assessment is presented in Vol 2.

8.4.3 A baseline report is presented in Vol 23 Appendix F.1 which details the data obtained for this site and identifies the contamination sources that may have affected the site. In addition to Vol 23 Appendix F, this section should also be read in conjunction with Vol 23 Figure F.1.1, Vol 23 Figure F.1.2 and Vol 23 Figure F.1.3 (see separate volume of figures).

Summary of baseline conditions

Geology

8.4.4 The site is underlain by surface cover of topsoil beneath which there is a layer of Made Ground extending to 2.9m bgl.

8.4.5 This was found to be underlain by River Terrace Deposits, Thanet Sand Formation and Chalk (see Vol 23 Appendix F.1, Vol 23 Table F.3 for the full geological succession).

Contamination

8.4.6 The main site (CSO drop shaft location and associated construction compound) is not identified to have had significant contaminative on-site land uses and is currently public open space.

8.4.7 The site was formerly Victorian era residential properties, which were subsequently redeveloped into larger housing blocks and were cleared in the 1970s.

8.4.8 Therefore, it is judged that there is the potential for relatively minor contamination of underlying soils to be present as a result of the clearance of previous housing (potential for backfilled basements and Victorian era fill [Made Ground] materials).

8.4.9 Limited contamination testing of the Made Ground soils and underlying River Terrace Deposits in the southeastern corner of the park recorded one sample of Made Ground (at 1.0m depth) to contain an elevated concentration of lead above withdrawn soil assessment criteria for industrial sites and residential properties (Defra/EA, 2002) [3].

8.4.10 Concentrations of polycyclic aromatic hydrocarbons(PAHs) were also recorded to be slightly elevated in comparison with widely used assessment criteria for residential land use but not in comparison with criteria for light industrial or commercial land uses (Land Quality Management/Chartered institute of Environmental Health, 2009)[4]. There are no assessment criteria for parks.

8.4.11 The contamination is typical of older urban areas and often relates to coal ash and clinker from domestic fires or fragments of lead flashing and paint from older properties (such as the cleared housing that formerly existed here).

8.4.12 Off-site contamination sources include former gas and chemical works, depots and former factories, which could impact the groundwater at depth beneath the site with a variety of contaminants including benzene, toluene, ethylbenzene, and xylenes (BTEX), phenols and other volatile organic compounds (VOCs) which could impact upon construction workers during below ground works. Current groundwater analysis from on-site boreholes does not indicate that these off-site sources have impacted groundwater beneath the site.

8.4.13 The main contaminants associated with the historical land-use include elevated levels of metals, PAHs, and sulphates in ash and clinker previously deposited from domestic fires (as have been recorded locally). These contaminants may be present in either soil, soil vapour and groundwater (including perched water) and may be hazardous to human health (eg as irritants, carcinogens or by their volatile or flammable properties) depending on the potential concentration of the substance, groundwater or surface water contaminants and in the case of sulphates, a risk to concrete structures.

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 (MoD), Public Records Office and the Port of London Authority (PLA). The report is presented in Vol 23 Appendix F.2.

8.4.15 The report establishes that the nearby areas suffered severe bomb damage during the 1940 to 1941 bombing campaign. Taking into account the findings of this study and the known extent of the proposed works, it is considered that there is an overall medium/high threat from UXO at the Deptford Church Street site.

Summary of receptors

8.4.16 The receptors identified at this site from the baseline survey (see Vol 23 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 and school users (high sensitivity), users of the adjacent Crossfield public open space (medium sensitivity) and workers in the adjacent light industrial or commercial land and church users (low sensitivity)

c. built environment: adjacent light industrial, commercial and residential buildings (low sensitivity), St Joseph's Roman Catholic Primary School building (medium sensitivity) and listed structures, including St Pauls Church, associated walls of the Churchyard and the London to Greenwich Railway viaduct (high sensitivity)

Construction base case

8.4.17 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 Section 8.4.

8.5.2 Where deemed necessary, 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 and in other areas of proposed excavation where necessary).

8.5.3 It is however considered unlikely on the basis of current information that there would be any need or benefit in undertaking pre-construction remediation.

8.5.4 It is assumed that the minor contamination recorded at depth could remain until the commencement of construction. Therefore some contamination is assumed by Year 1 of construction.

Development of conceptual model

Interactions between source-pathway-receptor

8.5.5 The following section outlines how the contamination sources summarised in paras. 8.4.6 to 8.4.13 may interact with the receptors identified during the construction phase (see para. 8.4.16) 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.

8.5.7 The SPR interactions are summarised in Vol 23 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 23 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	Migration in groundwater	N/A
Soil gases/vapours	Inhalation	Vapour migration (and subsequent inhalation)	N/A
UXO	UXO detonation	UXO detonation	UXO detonation

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 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 either 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 medium/high risk site such as Deptford Church Street, 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, Crossfield Public Open Space and church users and a **minor adverse** effect on the adjacent residential land and St Joseph's Roman Catholic Primary School users (although the effect is defined as minor adverse, it is considered unlikely that the effects 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, Crossfield Public Open Space and church users and a minor adverse effect on the adjacent residential land and St Joseph's Roman Catholic Primary School users (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).

Built environment

8.5.27 Impacts from existing land quality relate to the accidental detonation of UXO during preliminary surveys or main construction works.

8.5.28 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 (eg, from UXO) to the built environment associated with the construction phase of the proposed development.

8.5.29 With these 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 adjacent commercial, light industrial, residential buildings and the St Joseph's Roman Catholic Primary School building and a **minor adverse** effect on the listed structures (St Pauls Church and associated walls of Churchyard and the London to Greenwich Railway viaduct) (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).

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

Construction effects

8.7.1 Of the projects described in Vol 23 Appendix N which could potentially give rise to cumulative effects with the proposed development at Deptford Church Street, two developments have been identified (see Vol 23 Table 8.3.1).

8.7.2 No cumulative effects of land quality 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

Construction effects

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 23 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 caused by 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 caused by 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 land-users and church users (Low)	Health effects caused by exposure to wind-blown dusts or vapours	Negligible	None	Negligible
	Health effects from detonation of UXO	Negligible	None	Negligible
Adjacent land-users, Crossfield Public Open Space (Medium)	Health effects caused by exposure to wind-blown dusts or vapours	Negligible	None	Negligible
	Health effects from detonation of UXO	Negligible	None	Negligible
Adjacent land-users, residential and St Joseph's Roman Catholic Primary School land-users (High)	Heath effects caused by exposure to wind-blown dusts or vapours	Minor adverse	None	Minor adverse*
	Health effects from detonation of UXO	Minor adverse	None	Minor adverse*
Built environment - adjacent light industrial/commercial and	Damage to structures from detonation of UXO	Negligible	None	Negligible

Receptor (sensitivity)	Effect	Significance of effect	Mitigation	Significance of residual effect
residential buildings (Low)				
Built environment - St Joseph's Roman Catholic Primary School building (Medium)	Damage to educational structures from detonation of UXO	Negligible	None	Negligible
Built environment - listed structures, including St Pauls Church and associated walls of Churchyard and the listed London to Greenwich Railway viaduct (High)	Damage to listed structures from detonation of UXO	Minor adverse	None	Minor adverse*

** 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).

[3] Defra/EA. *Soil Guideline values for lead* (2002).

[4] Land Quality Management/Chartered institute of Environmental Health. *Generic Assessment Criteria for Human Health Risk Assessment*, 2nd Edition (2009).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street 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 23: Deptford Church Street 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 Deptford Church Street main 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 haul road and local 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 main tunnel does not run beneath this location, however, the drive for the Greenwich connection tunnel does. 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 and cumulative assessment.

9.1.5 There are no river services in the vicinity of the Deptford Church Street 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 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 23 Deptford Church Street 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 material would be by road. Estimated vehicle numbers and haul routes are presented in Vol 23 Sections 3.3 and 12.2.

Construction activities

9.2.3 Vol 23 Section 3.3 sets out the assumed construction duration and programme for the Deptford Church Street 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 and site clearance
d. diaphragm wall construction
e. shaft construction
f. shaft secondary lining
g. near ground structures including culvert works, interception structures and air management structures
h. 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 23 Appendix G.2.

9.2.6 Working hours have been subject to consultation with the local authority. As part of the *Code of Construction Practice (CoCP*) 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 hours (08:00-18:00 weekdays and 08:00-13:00 Saturdays).
b. extended working hours (18:00-22:00 weekdays, 13:00-17:00 Saturdays) to complete major concrete pours occurring approximately twice a week for four months during diaphragm walling and approximately once a month for other major concrete pours.

Code of Construction Practice

9.2.7 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*).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
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 designed 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. site hoarding would be 3.6m high at this site

b. the contractor's site layout and operation would take into consideration the proximity to both St Paul's Church and St Joseph's Roman Catholic School. Potential site specific noise mitigation measures may be required and could include, enhanced noise barriers (additional, higher and/or double skinned barriers), design of egress gate on Coffey Street, gate closure during sensitive periods, consideration of limiting activities during church services and school exam periods, and avoiding extended working hours where practicable when there are special events in the church.

Operation

9.2.9 A below ground ventilation structure would be constructed to contain plant and filter equipment. Ventilation columns would also be constructed. The 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 design of the drop shaft would control the descent of water by channelling the flow into a vortex around the internal face of 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.

9.2.12 The operational plant associated with the surface structures would incorporate environmental design measures to control noise emission to the nearest noise sensitive receptors to acceptable noise limits. These limits are as defined by the Local Authority in which the receptor lies; at Deptford Church Street, receptors within London Borough (LB) of Lewisham. The environmental design measures have considered the following noise sources:

a. hydraulic plant for penstock operation (pumps, motors)

b. uninterruptable power supply (UPS) plant

9.2.13 In considering the noise from the above items, the sound insulation of the housing for the equipment has been taken into consideration.

9.3 Assessment methodology

Engagement

9.3.1 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 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 the LB of Lewisham. Confirmation on the survey methodology was received from the LB of Lewisham in June 2011.

9.3.3 Site specific consultation comments relevant to noise or vibration are presented in Vol 23 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 23 Table 9.3.1 Noise and vibration – consultation comments

Organisation	Comment	Response
LB of Lewisham, phase two consultation response, February 2012	There are two Primary Schools close-by the proposed site; St Joseph's Roman Catholic Primary School is opposite the site and the new Tidemill Academy (due to be completed this year) is very near. In addition, students attending Addey and Stanhope School who live in the area may also have their journey to and from school affected. Officers have concerns about the effects of noise, vibration and dust on the school children.	St. Joseph's School and Tidemill Academy have been included as receptors and effects from noise and vibration have been considered in this assessment.
LB of Lewisham, phase two consultation response, February 2012	In addition to this, there will be a severe impact on the life of the school and potentially on teaching and learning. Both indoor and outdoor learning will be impacted by noise and air quality. Children suffering from asthma may be affected	St. Joseph's School has been included as a receptor and effects from noise and vibration have been considered in this assessment.
LB of Lewisham, phase two consultation response, February 2012	The impact of the construction noise to St Joseph's School has not been assessed and the impact on the staff and students as well as on the learning environment is concerning. A full assessment of the noise effects on the use of the school from the construction site is required	St. Joseph's School has been included as a receptor and effects from noise and vibration have been considered in this assessment.

Organisation	Comment	Response
LB of Lewisham, phase two consultation response, February 2012	The PEIR identifies a relatively small number of receptors (under 100) and identifies residential uses as being of high sensitivity, but consider both St Paul's church and St Joseph's Primary School as medium sensitivity. Given the very close proximity of St Joseph's Primary School to the works site, the school should be identified as a high sensitivity site. The hours of work for the construction are during the school hours and therefore children and teachers could be exposed to noise for longer periods than a residential property where the occupiers may be out during the day.	The sensitivity of these two receptors has been revised and the assessment now considers both St Paul's church and St Joseph's Primary School as high sensitivity receptors.
LB of Lewisham, phase two consultation response, February 2012	There is growing evidence linking detrimental effects on child learning to high levels of ambient noise. While many of the studies focus on noise from aircraft and road traffic, the principle of long term noise exposure also applies to a long-term construction site where the maximum noise levels are likely to be higher.	The *CoCP* requires that best practicable means are demonstrated at all times to minimise noise. This assessment is based upon the current ambient noise level, the predicted noise levels during construction and national guidance regarding noise incident at schools.
LB of Lewisham, phase two consultation response, February 2012	Building Bulletin 93, published in 2003, provides important assessment criteria that, although it is primarily written for the design of new school buildings to create environments conducive to learning, contains noise limits, derived through research, that should be reviewed against any assessment of the construction impacts at this site.	The assessment is based upon consideration of internal noise levels within the classrooms at the worst-affected areas of the school.
LB of Lewisham, phase two	The BB93 states: For new schools, 60 $dBL_{Aeq,30min}$ should be regarded as	The assessment is based upon the

Organisation	Comment	Response
consultation response, February 2012	an upper limit for external noise at the boundary of external premises used for formal and informal outdoor teaching, and recreational areas' and 'Noise levels in unoccupied playgrounds, playing fields and other outdoor areas should not exceed 55 $dBL_{Aeq,30min}$ and there should be at least one area suitable for outdoor teaching activities where noise levels are below 50 $dBL_{Aeq,30min}$. If this is not possible due to a lack of suitably quiet sites, acoustic screening should be used to reduce noise levels in these areas as much as practicable, and an assessment of predicted noise levels and of options for reducing these should be carried out.'	worst-affected part of the school which is the upper floor classrooms which are not fully screened from the worksite. The assessment considers the guidance from BB93, although as noted in the comments this guidance doesn't strictly apply to existing schools.
LB of Lewisham, phase two consultation response, February 2012	It also quotes an $L_{Aeq\ (30min)}$, 35dB for indoor ambient noise levels upper limit within a primary school classroom. The WHO Guideline for Community Noise also defines a level of 35dB over the classroom period and defines the critical health effects as speech intelligibility, disturbance of information extraction and message communication.	The assessment is based upon the worst-affected part of the school which is the upper floor classrooms which are not fully screened from the worksite. The assessment considers the guidance from BB93, although as noted in the comments this guidance doesn't strictly apply to existing schools.
LB of Lewisham, phase two consultation response, February 2012	If the assessment results in a significant increase to the BB93 levels then, as a minimum, it would be expected that within a *Part B COCP*, there should be a commitment to the following: Levels of 65 $dBL_{Aeq,1\ h}$ and of 70 $dBL_{Aeq,1\ minute}$ will apply as measured at 1 m from the façade of the building during school hours and in term time. If these limits are predicted to be	Rather than working to limits, the project, through the *CoCP,* is required to demonstrate that best practicable means are adopted at all times to minimise noise and vibration from all work sites. The *CoCP* also

Organisation	Comment	Response
	exceeded for at least ten school days out of any period of fifteen consecutive days or alternatively 40 school days in any 6 month period, then changes to the work programme in maximising the work during school holidays will be applied so these limits can be maintained	specifies that all works must be undertaken under a prior consent which is agreed beforehand with the LB of Lewisham. The project would manage the works in a manner which reduces the disturbance from noise and vibration. This could include, amending working schedules to avoid key periods in the school term and if practicable, programming noisier activities for holidays and outside of the normal school day. There remains a risk that for short durations the LB of Lewisham recommended levels would be exceeded, however, before works starts it must be demonstrated to LB of Lewisham that the works are minimising noise and vibration at all times and the project would be in regular contact with the school to try to minimise disturbance as far as practicable.
LB of Lewisham, phase two consultation	A full assessment of the noise effects on the use of the school from the construction site is required and	St. Joseph's School has been included as a receptor in the

Organisation	Comment	Response
response, February 2012	unless it can be demonstrated that the impacts of the proposal can be satisfactorily mitigated, the proposal will be contrary to Lewisham's retained UDR policy ENV.PRO11 which seeks to resist development that would lead to unacceptable levels of noise	noise assessment. Works would be undertaken under a prior consent, which is agreed beforehand with the LB of Lewisham.
English Heritage, phase two consultation response, February 2012	English Heritage requests that the Church of St Paul's Grade I listed status is identified in paragraph 9.4.1 on page 103, to ensure that its significance is understood, as this is the first time the Church is referred to in this section of the PEIR, and it may be the only part of the PEIR reviewed by some people.	The Grade I listed status of the building does not directly affect the noise or vibration assessment unless it were deemed to be particularly structurally vulnerable to vibration. However reference to the church's status has been included in the assessment.
English Heritage, phase two consultation response, February 2012	English Heritage notes that all receptors (other than the Church of St Paul's) are assessed as having significant noise impacts at paragraph 9.5.22 on page 105 even where they are assessed as being receptors of the same significance. It does not appear to us to be justified to assess the church as incurring less noise impact than the other receptors – particularly given the contemplative/reflective purpose of a church and its churchyard as well as its daily use for worship.	St. Paul's Church has been assessed as a 'high sensitivity' non-residential sensitive receptor in the assessment. The assessment assumptions (including typical construction methods) have been refined since the PEIR assessment and the significance of the impact at the Church has been reassessed and presented herein.
English Heritage, phase two consultation response, February 2012	While English Heritage can concur with the assessment of vibration and noise at the operational phase of the project as insignificant (see Table 9.8.2 on page 118), we do not agree with Table 9.8.1 on page 117	It is understood that the St Paul's Sinfonia group no longer uses St Paul's Church for concerts and recordings. However

Organisation	Comment	Response
	concerning the assessment of these factors as insignificant during the construction phase of the project. We consider that our concerns are magnified by paragraph 9.9.1 on page 119, which states that there has been no assessment that takes account of the use of St Paul's for choral and orchestral concerts. It should be noted that the Church of St Paul's is also used for recording music, something requiring very significant levels of tranquillity, and which is a vital source of income for the Church.	the assessment takes into account the potential for such uses by other organisations. Effects on the amenity of church users are assessed in Volume 23, Section 10: Socio-economics. The project would manage the works in a manner which reduces the disturbance from noise and vibration. This could include, amending working schedules to limit activities during church services and special events at the church.

Baseline

9.3.4 The baseline methodology follows the methodology provided in Volume 2, Environmental assessment methodology. There are no site specific variations for this site.

Construction

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

9.3.6 Section 9.5 details the likely significant effects arising from the construction at Deptford Church Street. The nearest Thames Tideway Tunnel site that could give rise to additional effects on noise and vibration is Greenwich pumping station, which is more than 300m away and well screened by existing buildings from the receptors considered in this report. Therefore no other Thames Tideway Tunnel sites are considered in this assessment.

9.3.7 The construction noise and vibration assessment has considered the effects across the whole duration of the construction phase (Years 1 to 4) and the worst-case predicted exposure levels are reported. The development case (with the Thames Tideway Tunnel project) has been assessed against the base case (without the Thames Tideway Tunnel project).

9.3.8 None of the schemes outlined in the site development schedule (Vol 23 Appendix N) are considered relevant to the base case assessment as they are either under construction, outside of the 300m assessment area or are further from the works than other receptors included in the assessment.

9.3.9 Of the schemes outlined in the site development schedule (Vol 23 Appendix N) the Giffin Street residential development and the Creekside Village East development are considered relevant to the construction cumulative assessment as both are assumed to be under construction at the same time as the Deptford Church Street site. All others sites are either outside of the 300m assessment area or are assumed to be complete and operational by Site Year 1 of construction.

9.3.10 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 Volume 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. 9.5.42.

Construction assessment area

9.3.11 As described in Volume 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

9.3.12 The operational phase assessment methodology follows the methodology provided in Volume 2. Site specific variations to this methodology are set out below.

9.3.13 For this site at residential receptors, the 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(A) below the typical background noise level over the operational period of the plant at 1m from the façade of the nearest residential receptor.

9.3.14 The operational assessment year is taken to be Year 1 of operation.

9.3.15 Section 9.6 details the likely significant effects arising from the operation of the Deptford Church Street site. There are no other Thames Tideway Tunnel 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 sites are considered in this assessment.

9.3.16 None of the schemes outlined in the site development schedule (Vol 23 Appendix N) are considered relevant to the operational assessment base

case as they are either outside of the 300m assessment area or are further from the works than other receptors included in the assessment.

9.3.17 There are no developments identified in the site development schedule (Vol 23 Appendix N) that are considered relevant for the operational cumulative assessment, because due to their use, none are expected to generate significant noise or vibration levels during their operation.

9.3.18 Based on the traffic flow, speed or composition change criteria specified in Volume 2, there are no routes where potential for operational traffic noise effects would occur.

Operational assessment area

9.3.19 Operational effects are considered up to 300m from the site boundary, although the focus is on those receptors closest.

Assumptions and limitations

9.3.20 The generic assumptions and limitations associated with this assessment are presented in Volume 2. The site specific assumptions are presented in the following section.

Assumptions

9.3.21 The working hours assumed for the assessment are as described in para. 9.2.6.

Limitations

9.3.22 There are no limitations to the assessment at this site.

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 23 Appendix G.1. Vol 23 Table 9.4.1 shows the measured ambient noise levels for the day, evening and night time periods.

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 23 Table 9.4.1 (and shown in plan view in Vol 23 Figure 9.4.1, see separate volume of figures). These were selected as they are representative of the range of noise climates where sensitive receivers are situated around the site. The approximate number of residential properties affected at each location (where known) is indicated in Vol 23 Table 9.4.2.

9.4.5 The nearest residences to the site are to the south on Resolution Way on the other side of the railway viaduct. To the east of the site are further residences at Congers House and Farrer House within LB of Lewisham. Berthon Street is also located to the east of the site within the Royal Borough (RB) of Greenwich (see Vol 23 Figure 9.4.1, separate volume of figures). To the west of the site are the rear façades of the mixed residential and commercial properties on Deptford High Street.

9.4.6 The non-residential noise sensitive receptors selected for assessment are St. Joseph's Primary School, the Grade I listed St. Paul's Church, Tidemill Academy School and the Wavelengths leisure centre and library.

9.4.7 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

9.4.8 The noise and vibration sensitive receptors have been assessed according to their sensitivity, using the methodology outlined in Volume 2 Section 2.3. The sensitivities of all assessed receptors are presented in Vol 23 Table 9.4.1.

Vol 23 Table 9.4.1 Noise and vibration – sensitive receptor locations and ambient noise levels

Ref	Receptor addresses	Sensitivity	Local authority	Measured average ambient noise level, day/ evening, dBL_{Aeq*}	Noise survey location
DC1	St. Joseph's Primary School (school)	High	LB of Lewisham	59/56	DCS02
DC2	134-160 Deptford High Street (residential)	High	LB of Lewisham	63/63	DCS03
DC3	St. Paul's Church (Church)	High	LB of Lewisham	56/56	DCS01
DC4	1-22 Berthon Street (residential)	High	RB of Greenwich	63/63	DCS03
DC5	Congers House (residential)	High	LB of Lewisham	63/63	DCS03
DC6	Farrer House	High	LB of	63/63	DCS03

Ref	Receptor addresses	Sensitivity	Local authority	Measured average ambient noise level, day/ evening, dBL_{Aeq*}	Noise survey location
	(residential)		Lewisham		
DC7	Resolution Way (residential)	High	LB of Lewisham	63/63	DCS03
DC8	Tidemill Academy (school)	High	LB of Lewisham	63/63	DCS03

* *Noise level includes correction for façade acoustic reflection unless receptor position is an open outdoor space (eg park)*

9.4.9 The baseline noise level is considered representative of the relevant receptor. Consideration has been 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).

9.4.10 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 Deptford Church Street site are as shown in Vol 23 Table 9.4.2. As described in the assessment methodology, this follows the method as defined in Vol 2 Section 9.5

9.4.11 The assessment of significance at non-residential receptors is made using the impact criteria described in Volume 2 Section 9.5 (where appropriate) and other factors described in Volume 2 Section 2.4.

Vol 23 Table 9.4.2 Noise – residential sensitive receptors and airborne construction noise assessment categories

Ref	Noise sensitive receptor (No. of dwellings)	Ambient noise level, rounded to nearest $5dBL_{Aeq*}$ day / evening	Assessment category* day/ evening	Impact criterion threshold level, day, $dBL_{Aeq\ 10hour}$/ evening $dBL_{Aeq\ 1hour}$
DC2	134-160 Deptford High Street (14)	65/65	B/C	70/65
DC4	1-22 Berthon Street (22)	65/65	B/C	70/65
DC5	Congers House (40)	65/65	B/C	70/65
DC6	Farrer House (40)	65/65	B/C	70/65
DC7	Resolution Way (35)	65/65	B/C	70/65

* *From 'ABC' method – BS5228:2009* (British Standards Institution, 2009)[3]

Construction base case

9.4.12 The construction base case, taking into account the schemes described in Section 9.3, would not change, as there are no additional sensitive receptors indicated which fall within the assessment area.

9.4.13 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). 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. 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.

9.4.14 There is an existing vibration source (a mainline rail viaduct, with regular commuter trains travelling towards Charing Cross and Kent) immediately alongside the site however, vibration levels are unlikely to change between the present time and the base case.

Operational base case

9.4.15 The base case in Year 1 of operation, taking into account the schemes described in Section 9.3, would not change as there are no additional sensitive receptors indicated which fall within the assessment area.

9.4.16 The operational base case 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 23 Table 9.5.1 and Vol 23 Table 9.5.2. The tables show 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 tables also show 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 columns in the tables show 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 23 Table 9.5.1), further

assessment of the likely noise ingress to the interior of the building has been carried out to more precisely estimate the resulting noise impact on the occupants. The noise ingress would depend on the degree of façade noise 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 across the duration of the construction phase, Vol 23 Appendix G Plate G.5 to Plate G.12 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. The predicted impacts and assessed effects at each representative receptor location are described below.

Impacts at residential receptors

9.5.3 The results for residential receptors are shown below.

Vol 23 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 <u>all</u> 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
DC2 / 134-160 Deptford High Street (14)	70	46 – 60 (day)	49	0	-10	0
	65	41 – 55 (eve)	41	0	-10	0
DC4 / 1-22 Berthon Street (22)	70	48 – 63 (day)	51	0	-7	0
	65	41 – 56 (eve)	41	0	-9	0
DC5 / Congers House (40)	70	55 – 69 (day)	58	0	-1	0
	65	46 – 62 (eve)	46	0	-3	0
DC6 / Farrer House (40)	70	53 – 69 (day)	56	0	-1	0
	65	45 - 61 (eve)	45	0	-4	0
DC7 / Resolution Way (35)	70	57 – 69 (day)	60	0	-1	0
	65	55 – 65 (eve)	55	0	0	0

[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 Volume 2*

[c] *Construction noise only, excludes ambient noise. Refer to Volume 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*

134-160 Deptford High Street (DC2)

9.5.4 The residential properties on Deptford High Street are three storey mixed commercial and residential buildings. The properties are located at a distance of approximately 70m from the site boundary and would be screened from the majority of activities by the site hoardings. The predicted noise levels at these dwellings due to construction activities are shown in Vol 23 Table 9.5.1.

9.5.5 The typical daytime noise levels (most frequently occurring monthly level) is 49dBL_{Aeq}. The site establishment works are expected to cause the worst-case noise level of 60dBL_{Aeq}.

9.5.6 During the evening, the extended concrete activities are expected to cause the worst-case average monthly noise levels of 55dB$L_{Aeq.}$. During the remainder of the construction works, the evening works are limited to one concreting event per month and the levels from these concrete pours are predicted to be much lower.

9.5.7 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant**.

9.5.8 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.

1-22 Berthon Street (DC4)

9.5.9 The residential properties on Berthon Street are four storey residential buildings. The properties are located at a distance of approximately 70m from the site boundary and would be screened from the majority of construction activities by the site hoardings. The predicted noise levels at these dwellings due to construction activities are shown in Vol 23 Table 9.5.1.

9.5.10 The typical daytime noise levels (most frequently occurring monthly level) is 51dBL_{Aeq}. The site establishment works are expected to cause the worst-case noise level of 63dBL_{Aeq}.

9.5.11 During the evening, the extended concrete activities are expected to cause the worst-case average monthly noise levels of 56dBL_{Aeq}. During the remainder of the construction works, the evening works are limited to one concreting event per month and the levels from these concrete pours are predicted to be much lower.

9.5.12 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant**.

9.5.13 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.

Congers House (DC5)

9.5.14 Congers House is a five storey residential building on the eastern side of Deptford Church Street. The properties are located at a distance of approximately 45m from the site boundary and the upper floors would have a partial view of the majority of activities within the site. The predicted noise levels at these dwellings due to construction activities are shown in Vol 23 Table 9.5.1.

9.5.15 The typical daytime noise levels (most frequently occurring monthly level) is 58dBL_{Aeq}. The piling works for the culvert is expected to cause the worst-case noise level of 69dBL_{Aeq}.

9.5.16 During the evening, the extended concrete activities are expected to cause the worst-case average monthly noise levels of 62dBL_{Aeq}. During the remainder of the construction works the evening works are limited to one concreting event per month and the levels from these concrete pours are predicted to be much lower.

9.5.17 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant.**

9.5.18 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.

Farrer House (DC6)

9.5.19 Farrer House is a four storey residential building on the eastern side of Deptford Church Street. The properties are located at a distance of approximately 50m from the site boundary and the upper floors would have a partial view of the majority of activities within the site. The predicted noise levels at these dwellings due to construction activities are shown in Vol 23 Table 9.5.1.

9.5.20 The typical daytime noise levels (most frequently occurring monthly level) is 56dBL_{Aeq}.During the daytime, the piling for the culvert is expected to cause the worst-case noise level of 69dBL_{Aeq}.

9.5.21 During the evening, the extended concrete activities are expected to cause the worst-case average monthly noise levels of 61dBL_{Aeq}. During the remainder of the construction works, the evening works are limited to one concreting event per month and the levels from these concrete pours are predicted to be much lower.

9.5.22 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant.**

9.5.23 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.

Resolution Way (DC7)

9.5.24 Resolution Way is a six storey residential building to the south of the site over the railway line. The properties are located at a distance of approximately 40m from the site boundary and the upper floors would have a partial view of the majority of activities within the site. The predicted noise levels at these dwellings due to construction activities are shown in Vol 23 Table 9.5.1.

9.5.25 The typical daytime noise levels (most frequently occurring monthly level) is 60dBL_{Aeq}.During the daytime, the site establishment and shaft works is expected to cause the worst-case noise level of 69dBL_{Aeq}.

9.5.26 During the evening, the extended concrete activities are expected to cause the worst-case average monthly noise levels of 65dBL_{Aeq}. During the remainder of the construction works, the evening works are limited to one concreting event per month and the levels from these concrete pours are predicted to be much lower.

9.5.27 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant.**

9.5.28 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.

Impacts at non-residential receptors

9.5.29 The results for non-residential receptors are shown below.

Vol 23 Table 9.5.2 Noise – impacts at non-residential receptors

Ref / receptor	Receptor sensitivity[a]	Range of construction noise levels, dBL_{Aeq}[b,c,d]	Ambient baseline noise level, dBL_{Aeq}[d]	Typical[e] monthly construction noise levels, dBL_{Aeq}	Magnitude	
					Total duration above ambient for all works, months	Worst-case excess above ambient, dBL_{Aeq}
DC1/ St. Joseph's Primary School	High	50 – 64 (day)	59 (day)	53	8	+5
DC3 / St. Paul's Church	High	52 – 65 (day)	56 (day)	56	25	+9
		47 – 61 (eve)	56 (eve)	47	5	+5
DC8 / Tidemill Academy	Medium	47 – 62 (day)	63 (day)	50	0	-1

[a] *Assumed typical façade transmission loss and appropriate internal noise guidelines*

[b] *Floors subject to highest level assessed – not necessarily the highest floor level*

[c] *Construction noise only, excludes ambient noise. Refer to Volume 2*

[d] *Noise level includes correction for façade acoustic reflection unless receptor position is an open outdoor space (eg park)*

[e] *Most frequently occurring monthly construction noise level during works*

St. Joseph's Primary School (DC1)

9.5.30 St. Joseph's Primary School is located approximately 40m from the site boundary. The predicted noise levels have been made at the upper floor of the main school building, and the assessment considers this part of the school to be subject to the highest construction noise levels. The assessment also considers the temporary classrooms located in the playground. Whilst they are closer to the site, they are fully screened by the site hoarding.

9.5.31 The typical daytime noise levels (most frequently occurring monthly level) is 53dBL_{Aeq}. The worst-case predicted noise level of 64dBL_{Aeq} during the daytime is greater than the current ambient noise level for the daytime period. Although the noise level would increase relative to the ambient noise level and this could be noticeable inside the building, the increase in average noise levels inside the building is not expected to exceed guideline noise levels for classroom use with windows closed based on typical noise insulation for a façade of this type[4].

9.5.32 As the noise level presented in Vol 23 Table 9.5.2 is based on an average noise level over a month period, there remains a risk that for shorter durations during the construction period the guidance levels for classrooms would be exceeded.

9.5.33 Given the sensitivity of the receptor and that there is a risk that the guidance levels would potentially be exceeded, construction noise at this receptor is considered **significant**.

St. Paul's Church (DC3)

9.5.34 St. Paul's Church is located approximately 35m from the site boundary and the church windows would be largely screened by the proposed site hoarding. The church is most regularly used as a place of worship, however it is also used as a venue for music and video recordings, owing to the good acoustic conditions and low internal noise levels. The noise level at the churchyard would be similar to the level incident at the church minus any allowance for a façade reflection.

9.5.35 The typical daytime noise levels (most frequently occurring monthly level) is 56dBL_{Aeq}. The worst-case predicted noise level of 65dBL_{Aeq} during the daytime is greater than the current ambient noise level for seven months.

9.5.36 During the 25 month period where the predicted construction noise is greater than the ambient noise level, the average noise level inside the church is expected to exceed guideline noise levels based on typical noise insulation for a façade of this type for 8 months.

9.5.37 The worst-case predicted evening noise level for this receptor is shown in Vol 23 Table 9.5.2 is a noise level of 61dBL_{Aeq}. The concreting events causing these impacts are only likely to take place twice a week during the diaphragm wall construction. During the remainder of the construction works, the evening works are limited to one concreting event per month and the levels from these concrete pours are predicted to be much lower

9.5.38 The increased noise level is likely to be particularly noticeable during the daytime. Given the duration and sensitivity of the receptor, construction noise at this receptor is considered **significant**.

Tidemill Academy (DC8)

9.5.39 Tidemill Academy is located approximately 40m from the site boundary, south of the railway line. The school building and playground is fully screened from the railway by the site hoarding and the railway viaduct.

9.5.40 This receptor is also considered representative of the noise incident at the Wavelength leisure centre and library.

9.5.41 The typical daytime noise levels (most frequently occurring monthly level) is 50dBL_{Aeq}. The worst-case predicted noise level is 62dBL_{Aeq} during the daytime which is less than the current ambient noise level for the respective period. As the construction noise levels do not exceed the ambient noise levels, any increase in noise levels inside the building is not expected to cause disturbance to users. This is therefore assessed as **not significant**.

Road-based construction traffic

9.5.42 Road vehicles would access the site from the major road network (Deptford Church Street / A2209) in via Crossfield Street and exit the site onto Coffey Street.

9.5.43 Currently Coffey Street and Crossfield Street have a low flow and percentage heavy goods vehicle (HGV) movements compared to Deptford Church Street and therefore the introduction of the addition HGV movements on to these roads would result in the highest potential change in noise level (see Vol 23 Table 9.5.3).

9.5.44 The traffic modelling shows that the 18hr Annual Average Weekday Traffic (AAWT) flow on Coffey Street of 861 vehicles per day (vpd), with average speeds of 20 mph (32 kph) and 3.1 % HGVs. The total number of HGVs on this route is currently 27 per day.

9.5.45 The construction programme would result in varying traffic generation but, during the peak construction period, the traffic generation is forecast to average 32 HGVs per day, equivalent to 64 movements per day, on Coffey Street as vehicles would only exit onto Coffey Street (but enter the site from Crossfield Street). Therefore the Coffey Street flow would increase to 925 vpd and 9.8% HGVs.

Vol 23 Table 9.5.3 Noise – construction traffic change

Road	vpd	Average speed (km/hr)	% HGVs	Change (dB)
Coffey Street (Pre-construction)	861	32	3.1	1.8
Coffey Street (Peak construction period)	925	32	9.8	

9.5.46 A less than 3dB change is predicted during the peak construction period on the road with the lowest current flow and therefore the change in noise level due to construction traffic is considered to be **not significant** on this road or any road with a higher existing flow.

Vibration

9.5.47 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.

9.5.48 The assessment has been conducted using the methodology defined in Volume 2.

9.5.49 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 23 Table 9.5.4 .

Vol 23 Table 9.5.4 Vibration – impact and magnitude of human response to

Ref	Receptor	Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)*	Value/ sensitivity	Magnitude
DC 1	St. Joseph's Primary School	<0.4	High	No impact – 'Low probability of adverse comment'
DC 2	134-160 Deptford High Street	<0.2	High	No impact – below the 'Low probability of adverse comment'
DC 3	St. Paul's Church	<0.4	High	No impact – 'Low probability of adverse comment'
DC 4	1-22 Berthon Street	<0.2	High	No impact – below the 'Low probability of adverse comment'

Ref	Receptor	Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)*	Value/ sensitivity	Magnitude
DC 5	Congers House	<0.3	High	No impact – below the 'Low probability of adverse comment'
DC 6	Farrer House	<0.3	High	No impact – below the 'Low probability of adverse comment'
DC 7	Resolution Way	<0.3	High	No Impact – below the 'Low probability of adverse comment'
DC 8	Tidemill Academy	<0.3	High	No impact – below the 'Low probability of adverse comment'

Most affected floor

9.5.50 The predicted eVDV levels at all receptor locations fall within or below the 'Low probability of adverse comment' band, as described in Volume 2 Section 2 and therefore significant effects are not anticipated. These predicted levels are based upon the highest anticipated exposures during the most intense vibration activities within the site.

9.5.51 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 Volume 2. The results of the assessment of construction vibration are presented in Vol 23 Table 9.5.5.

9.5.52 The highest levels of vibration are associated with the vibratory piling required to start the shaft construction, which would take less than one week to complete, and other vibratory compaction across the site.

Vol 23 Table 9.5.5 Vibration – building vibration impacts and their magnitudes

Ref	Receptor	Impact (highest predicted PPV across all activities, mm/s)	Value/ sensitivity	Magnitude
DC 1	St. Joseph's Primary School	<0.5	High	No impact – below threshold of potential cosmetic damage
DC	134-160 Deptford High	<0.5	High	No impact – below threshold of

Ref	Receptor	Impact (highest predicted PPV across all activities, mm/s)	Value/ sensitivity	Magnitude
2	Street			potential cosmetic damage
DC 3	St. Paul's Church	<0.5	High	No impact – below threshold of potential cosmetic damage
DC 4	1-22 Berthon Street	<0.5	High	No impact – below threshold of potential cosmetic damage
DC 5	Congers House	<0.5	High	No impact – below threshold of potential cosmetic damage
DC 6	Farrer House	<0.5	High	No impact – below threshold of potential cosmetic damage
DC 7	Resolution Way	<0.5	High	No impact – below threshold of potential cosmetic damage
DC 8	Tidemill Academy	<0.5	High	No impact – below threshold of potential cosmetic damage

9.5.53 The vibration levels reported here are well below the levels likely to cause cosmetic building damage according to the criteria described in Volume 2 Section 2.

9.5.54 Vibration effects to all receptors are **not significant**.

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 operational sources identified for assessment.

Noise from plant machinery at above ground structure

9.6.2 A passive ventilation system is to be installed at Deptford Church Street and therefore there is no requirement to install active ventilation equipment at this location.

9.6.3 The appropriate emission limits are shown below in Vol 23 Table 9.6.1, based on local authority requirements to ensure that no adverse effects would occur. As there would be 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 for the kiosks are required, this equipment would be controlled to meet the criteria in Vol 23 Table 9.6.1 although such equipment would be expected to have a relatively low noise emission (approximately 45dB(A) at 3m).

9.6.4 There would be a pump to maintain hydraulic pressure in the hydraulic pipework and rams for the penstocks although the noise emission would be short and infrequent. It is expected that this would produce a whirring noise about once a week with a duration of approximately 30 seconds to two minutes depending on the size of the penstock and hydraulic system. The plant would be operated for testing purposes once every three months. The power pack, pump and motor would be located within the kiosk and would be shielded with an acoustic surround if necessary to meet the requirements in Vol 23 Table 9.6.1.

9.6.5 Vol 23 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 23 Table 9.6.1 Noise – operational impacts

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensitivity	Magnitude
DC1	St. Joseph's Primary School	Daytime: 52dB$L_{Aeq,}$ 15 minutes	Plant noise emission level at receptor less than 52dBL_{Aeq}	High	Plant noise level below ambient daytime level – no adverse impact
DC2	134-160 Deptford High Street	Night-time baseline 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

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensitivity	Magnitude
DC3	St. Paul's Church	Evening: 56dB$L_{Aeq,}$ 15 minutes	Plant noise emission level at receptor less than 56dBL_{Aeq}	High	Plant noise level below ambient evening level – no adverse impact
DC4	1-22 Berthon Street	Night-time baseline 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
DC5	Congers House	Night-time baseline 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
DC6	Farrer House	Night-time baseline 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
DC7	Resolution Way	Night-time baseline 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 ambient daytime level – no adverse impact

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensitivity	Magnitude
			noise level		
DC8	Tidemill Academy	Daytime: 63dB$L_{Aeq,}$ 15 minutes	Plant noise emission level at receptor less than 66dBL_{Aeq}	High	Plant noise level below ambient daytime level – no adverse impact

* *Limit referred to is that identified for the Local Authority in which the receptor is located (see para.9.3.13).*
** *See para 9.6.6*

9.6.6 Background noise level measurements have not been undertaken for the night-time period at the Deptford Church Street site 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.

9.6.7 The results given above in Vol 23 Table 9.6.1 show that there are no adverse impacts and the effects of plant noise at these emission levels is assessed as **not significant**. In the case of the residential receptors, this is based on compliance with the local authority requirements 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

9.6.8 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, have been used to inform the assessment of noise and vibration during tunnel filling events. These studies (Jain and Kennedy, 1983)[5] are described in Volume 2 Section 2.4. The highest noise level measured on a mesh grille directly over a similar drop shaft, during this study, was 61dBL_{Aeq} during a severe storm event.

9.6.9 These events are not typical and only occur during severe rain storms. At Deptford Church Street, the drop shaft would be enclosed and any noise at the surface would be attenuated by the structure or the carbon filters and ventilation columns. At the surface the noise level would be approximately 46dBL_{Aeq} which is higher than the prevailing ambient noise level at this site but would be lower at any sensitive receptor located outside of the site.

9.6.10 The highest PPV measured directly at the existing drop shaft sites used in the case study as described in Volume 2 Section 2.4 was 0.034mm/s. These measured PPV values are below the levels for vibration to be just perceptible, according to the criterion given in Volume 2 Section 2.4.

Similarly, the levels are well below the transient and continuous vibration guideline criterion for building damage.

9.6.11 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 / less than ambient noise level at the receptors. Therefore this is assessed as **not significant**.

Operational maintenance

9.6.12 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.

9.6.13 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.

9.6.14 As no impacts have been identified from the operation of the site, noise from operational maintenance is assessed as **not significant**.

Noise from operational traffic

9.6.15 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.

9.6.16 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**.

9.7 Cumulative effects assessment

Construction effects

9.7.1 Of the projects described in Section 9.3 the Giffin Street residential development and the Creekside Village East development are considered relevant to the construction cumulative assessment as both are assumed to be under construction at the same time as the Deptford Church Street site.

9.7.2 The Giffin Street development area is located over 50m to the south of the Deptford Church Street site, screened by the railway viaduct and intervening buildings between the two areas. Given the distance and degree of screening, cumulative effects from this development are unlikely to cause cumulative effects.

9.7.3 Similarly, the Creekside Village East development would be screened by high-rise buildings to the east of the A2209 and is positioned over 200m

from the northeast of the Deptford Church Street site. It is assessed that cumulative effects from this development are unlikely to cause cumulative effects.

Operational effects

9.7.4 None of the projects described in Section 9.3, are considered relevant to the operational cumulative assessment at Deptford Church Street as due to their location and 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.

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 St Joseph's Primary School and St Paul's Church. However, no further practicable on site noise mitigation can be adopted above those measures identified in the *CoCP*.

9.8.2 St Joseph's Primary School and St Paul's Church do not qualify for noise insulation under the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* as they are not residential properties. They 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. Therefore residual effects reported in the ES for this receptor do not take the offsetting effect of the compensation programme into account.

Operation

9.8.3 No significant effects as a result of the operation of the site have been identified; hence no additional permanent noise mitigation is required at this location.

Monitoring

9.8.4 Monitoring of construction noise would be carried out as described in the *CoCP*. It is not anticipated that there would be any need for monitoring of operational noise.

9.9 Residual effects assessment

Construction effects

9.9.1 As discussed at para. 9.8.2, St Joseph's Primary School and St Paul's Church do not qualify for noise insulation as they are non residential premises. They may, however, be eligible for compensation under the *Thames Tideway Tunnel project compensation programme.* For the

purpose of the assessment the residual effects reported in the ES 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.

Operational effects

9.9.2 As no further mitigation measures are proposed, the residual operational effects remain as presented in Section 9.6.

9.10 Assessment summary

Vol 23 Table 9.10.1 Noise – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Surface construction noise				
DC1 - St. Joseph's Primary School	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for compensation (see para. 9.8.2)
DC2 - 134-160 Deptford High Street	Noise	Not significant	None	Not significant
DC3 - St. Paul's Church	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for compensation (see para. 9.8.2)
DC4 - 1-22 Berthon Street	Noise	Not significant	None	Not significant
DC5 - Congers House	Noise	Not significant	None	Not significant
DC6 - Farrer House	Noise	Not significant	None	Not significant
DC7 - Resolution Way	Noise	Not significant	None	Not significant
DC8 - Tidemill Academy	Noise	Not significant	None	Not significant
Road-based construction traffic				
Residential and non-residential properties adjacent to the	Noise	Not significant	None	Not significant

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Surface construction noise				
proposed vehicle route				

Vol 23 Table 9.10.2 Vibration – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
DC1 - St. Joseph's Primary School	Vibration	Not significant	None	Not significant
DC2 - 134-160 Deptford High Street	Vibration	Not significant	None	Not significant
DC3 - St. Paul's Church	Vibration	Not Significant	None	Not significant
DC4 - 1-22 Berthon Street	Vibration	Not significant	None	Not significant
DC5 - Congers House	Vibration	Not significant	None	Not significant
DC6 - Farrer House	Vibration	Not significant	None	Not significant
DC7 - Resolution Way	Vibration	Not significant	None	Not significant
DC8 - Tidemill Academy	Vibration	Not significant	None	Not significant

Vol 23 Table 9.10.3 Noise – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
DC1 - St. Joseph's Primary School	Noise	Not significant	None	Not significant
DC2 - 134-160 Deptford High Street	Noise	Not significant	None	Not significant
DC3 - St. Paul's Church	Noise	Not significant	None	Not significant
DC4 - 1-22 Berthon Street	Noise	Not significant	None	Not significant
DC5 - Congers House	Noise	Not significant	None	Not Significant
DC6 - Farrer House	Noise	Not significant	None	Not significant
DC7 - Resolution Way	Noise	Not significant	None	Not Significant
DC8 - Tidemill Academy	Noise	Not significant	None	Not significant

Vol 23 Table 9.10.4 Vibration – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
DC1 - St. Joseph's Primary School	Vibration	Not significant	None	Not significant
DC2 - 134-160 Deptford High Street	Vibration	Not significant	None	Not significant
DC3 - St. Paul's Church	Vibration	Not Significant	None	Not significant
DC4 - 1-22 Berthon Street	Vibration	Not significant	None	Not significant

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
DC5 - Congers House	Vibration	Not significant	None	Not Significant
DC6 - Farrer House	Vibration	Not significant	None	Not significant
DC7 - Resolution Way	Vibration	Not significant	None	Not Significant
DC8 - Tidemill Academy	Vibration	Not significant	None	Not significant

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] 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*. (2009).

[4] Building Bulletin 93: Acoustic design in schools, Department of Education and Skills

[5] Jain, S.C. and Kennedy, J.F. *Vortex-Flow Drop Structures for the Milwaukee Metropolitan Sewerage District Inline Storage System*. Iowa Institute of Hydraulic Research. IIHR Report No 264 (Jul 1983).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 10: Socio-economics

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Thames Tideway Tunnel

Environmental Statement

Volume 23: Deptford Church Street 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 Deptford Church Street site (main site). At this site effects during construction are considered on users of public open space, users of nearby schools, users of St Paul's Church and nearby residents. During the operational phase, effects are considered on users of the Crossfield Street public open space.

10.1.2 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.

10.1.3 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.

10.1.4 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 23 Deptford Church Street Figures).

10.1.5 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 The proposed development would require the temporary[i] use of the Crossfield Street Open Space for construction activity and also take up some of the adjacent carriageway on Deptford Church Street for part of the construction phase though two way traffic would be maintained. The proposed development also extends to the streets that abut the site; Coffey Street and Crossfield Street.

[i] The assessment considers the take up of space within Crossfield Open Space as temporary during the construction phase. However it is noted that a much reduced area of the open space would be required permanently in the operational phase.

10.2.3 Works at the site are expected to last approximately three and a half 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 23 Table 10.2.1.

Vol 23 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) Part A* to limit significant adverse air quality, noise, vibration, and visual impacts would help to avoid socio-economic effects, particularly amenity effects.

10.2.7 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 *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 A* also outlines that the contractor will take reasonable steps to engage with nearby residents, including those who may be detrimentally affected by construction impacts, and ensure that occupiers of nearby properties are informed in advance of works taking place,

[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.

including the type and duration of the activity (see Section 3 within the *CoCP Part A*).

10.2.9 Further site specific measures, which would reduce socio-economic effects and particularly amenity effects, are incorporated into the *CoCP Part B*. See the *Code of Construction Practice* sections in the air quality and odour, noise and vibration, and townscape and visual construction effect assessments (Sections 4.2, 9.2 and 11.2 respectively within this volume) within this assessment for details on the type of measures that would be employed.

10.2.10 Section 3 of the *CoCP Part B* also outlines that the contractor would liaise with St Paul's Church to coordinate traffic movements to and from site, in order to limit effects on the operation of the church as follows:

a. by limiting vehicle movements during funeral arrivals and departures

b. by facilitating horse delivery lorries for horse-drawn hearses

c. by completing Saturday works and traffic movements before 13:00.

10.2.11 Measures incorporated within Section 5 of the *CoCP Part B* that are relevant to socio-economic effects are as follows:

a. the footway diversion along Deptford Church Street site would be adequately signed

b. advance notice and publicity information would be required to inform regular users of changes and timing.

Operation

10.2.12 The requirement for above ground structures in the operational phase is described in Section 3 of this volume. Above ground structures would remain within Crossfield Street Open Space once construction work is complete. These structures would be within the parameter areas shown on the Site works parameter plan (see separate volume of figures – Section 1).

Environmental design measures

10.2.13 Measures which have been incorporated into the design of the proposed development (described in the design principles) include the:

a. design of the space to facilitate pedestrian movements around the site, as identified in the local authority's North Lewisham Links Strategy 2007

b. re-provision of adequate space for the school fire and emergency mustering point

c. minimisation of the amount of hardstanding within the site boundary as far as possible

d. design of a more integrated and accessible public space to enhance the setting of the listed church.

10.3 Assessment methodology

Engagement

10.3.1 Volume 2 of this assessment documents the overall engagement process which has been undertaken in preparing the *Environment Statement*. Specific comments relevant to this site for the assessment of socio-economics are presented in Vol 23 Table 10.3.1.

Vol 23 Table 10.3.1 Socio-economics – stakeholder engagement

Organisation	Comment	Response
LB of Lewisham, February 2012	Need to demonstrate how the proposed works can take place without adverse effects to the operation, safety of children and teachers, and the learning environment at the school.	Consideration of the effects on school users' amenity has been included.
LB of Lewisham, February 2012	Further information and detail is required to understand how parking restrictions during the works would impact on the ongoing operation of the businesses and to understand how many employees would potentially be affected.	Consideration of the effects on car parking has been included in the traffic and transport assessment.
English Heritage, February 2012	Request acknowledgement [with regard to St Paul's Church] of other impacts such as vibration, amenity and business all of which act to create a potentially serious secondary impact on the historic environment.	Consideration of the amenity effects of the proposed development at the site on St Paul's Church during construction has been included. Effects on the historic environment are assessed in Section 7: Historic Environment.
English Heritage, February 2012	The rating of the users of the churchyard and the staff and congregation of St Paul's appears to have had insufficient regard for the level of deprivation and social difficulty experienced by the Deptford Community. The Church (St Paul's) and its sheltered environs are a particularly valuable social resource compared to the	The local community profile within this volume, as well as the Health Impact Assessment (HIA) and Equalities Impact Assessment (EqIA) have comprehensively considered levels of deprivation in the local community. Surveys have also been undertaken of usage levels of the church yard as a quasi-public open space (subject to its opening hours) to help inform the

Organisation	Comment	Response
	same heritage asset in an affluent community (based on deprivation within the local area).	assessment.
English Heritage, February 2012	The impact on users of (St Paul's) churchyard and church is more likely to be major adverse, as the receptor appears to warrant a higher rating.	The sensitivity of this receptor and the magnitude of potential impacts have been comprehensively considered within this volume, based on a detailed review of the various relevant factors and the assessment framework set out in Volume 2.
Greater London Authority (including Transport for London), (Feb, 2012)	Ensure that any disruption to the school and church are minimised.	Measures have been included within the CoCP Part A and CoCP Part B to limit significant adverse air quality, noise, vibration, and visual impacts. Additionally, the air quality and odour and noise and vibration (see Sections 4 and 9 respectively) have assessed the effect of the project on these receptors. An assessment of amenity effects on the school and the church has also been included within this socio-economic assessment (see Section 10.5).
LB of Lewisham, October 2012	Crossfield Amenity Green will be made unavailable and inaccessible for an extended period (at least four years) during construction which will result in the loss of open space in an area with limited existing public open space. However it is a pivotal space in the Council's growth and regeneration strategy… …The level of new development in the surrounding area will place increasing pressure on the limited remaining open space and therefore	This socio-economic impact assessment includes an assessment of the effect on users of the Crossfield Street Open Space (or Crossfield Amenity Green) from its temporary closure. The assessment has been made based on consideration of the sensitivity of the receptors (users of the public open space resource) and the magnitude of impact. The assessment has been informed by surveys of the usage of the open space. The assessment that has been conduced is set out in Section

Organisation	Comment	Response
	maintaining access to this space in the coming years is an essential requirement.	10.5.
LB of Lewisham, October 2012	The type of alternative open space in the immediate area is not comparable. The PEIR refers to space at St Paul's Churchyard and Sue Godfrey Nature Reserve however these are not green open spaces that would be used in similar ways as the Crossfield Amenity Green. Sue Godfrey Nature Reserve is a nature reserve with paths and limited potential for other forms of recreation. Similarly the Church yard is a sensitive, enclosed environment with a graveyard which would not be an appropriate setting for some recreational activities.	This socio-economic impact assessment includes a description of the baseline, which includes consideration of alternative open space in the immediate area, their availability and the variations in the role and function of these spaces. These considerations have informed the assessment of sensitivity. The baseline and assessment of sensitivity of park users is set out in Section 10.4, and the assessment that has been conduced is set out in Section 10.5.
LB of Lewisham, October 2012	TTT must make available to LBL a full assessment of all sites and uses , not just those impacts identified as 'significant' in the PEIR.	The assessment that has been conduced is set out in full in Section 10.5.
LB of Lewisham, October 2012	Officers have concerns about the effects of traffic, noise, vibration and dust on the school children. There will be a severe impact on the life of the school and potentially on teaching and learning. Both indoor and outdoor learning will be impacted by noise and air quality. Thames Tideway Tunnel has not demonstrated how the proposed works can take place without adverse effects to the operation, safety of children and teachers, and the learning	Measures have been included within the CoCP Part A and CoCP Part B to limit significant adverse air quality, noise, vibration, and visual impacts. Additionally, the air quality and odour and noise and vibration (see Sections 4 and 9 respectively) have assessed the effect of the project on the school. An assessment of amenity effects on the school users has also been included within this socio-economic assessment (see Section 10.5).

Organisation	Comment	Response
	environment at the school.	
LB of Lewisham, October 2012	In response to socio-economic concerns made at phase 2 consultation, particularly regarding the impact on the school and education, TTT state (Main report on phase two consultation, page 414) that the assessment of effects is based on a methodology that has been agreed with LBL. This is not the case and LBL have not agreed to assessment methodologies. LB Lewisham have not agreed a methodology for the assessment of TTT proposals at Deptford Church Street on local businesses, as stated in the main report on phase two consultation (page 415).	Methodologies for the assessment have been set out in the *Scoping Report* and in the *Preliminary Environmental Information Report* (PEIR) and any comments received have been taken into account.
LB of Lewisham, October 2012	The impact on commercial units on Crossfield Street (particularly in relation to deliveries and servicing) has been not been assessed and the decision to scope out assessment of effects on businesses was made incorrectly and an assessment of the impact on the businesses should be undertaken. The project will clearly cause disturbance to the businesses and the businesses should have been further considered in the socio-economic impact assessment.	The Transport assessment (see Vol 23 Section 12.5) has considered the effect on parking in the vicinity of the site and found that there would be a low adverse impact on vehicle parking and a minor adverse effect on parking users in relation to receptors including the business and workplace occupiers at Crossfield Street. Those businesses with on site vehicle parking would continue to have access to their sites. Given the transport assessment findings, it is considered that the project would not cause significant disturbance to businesses.

Baseline

10.3.2 The baseline methodology follows the methodology described in Volume 2. 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 Table 9.5.1.

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

10.3.5 Section 10.5 details the likely significant effects arising from the construction at Deptford Church Street. There are no other Thames Tideway Tunnel project sites which would 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 23 Appendix N), there are none which have been considered relevant for the construction assessment base case as they are either outside the 250m assessment area for amenity effects or because they would not substantially alter the circumstances for the receptors which have been considered within the construction effects assessment for this site.

10.3.7 Of the developments listed in the site development schedule (see Vol 23 Appendix N), there are two which would have the potential to give rise to cumulative effects by replicating the same effect on potentially sensitive receptors during the construction phase. These developments are Giffin Street Regeneration Area located approximately 50m south of the site and Creekside Village East located approximately 220m east of the site. These developments are located within the relevant assessment areas and would be under construction at the same time as construction works at the Deptford Church Street site (in the peak construction year). Therefore, cumulative effects have been considered for these developments.

Operation

10.3.8 The base case is Year 1 of operation. The assessment area is as set out in Vol 2 Table 9.5.1.

10.3.9 The assessment methodology for the operation phase follows that described in Volume 2. There are no site specific variations for undertaking the operational assessment of this site.

10.3.10 Section 10.6 details the likely significant effects arising from the operation at Deptford Church Street. There are no other Thames Tideway Tunnel project sites which would 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.

10.3.11 Of the developments listed in the site development schedule (see Vol 23 Appendix N), there are none which would introduce new receptors into the operational base case; significantly alter circumstances for those receptors covered by the operational assessment; or give rise to cumulative effects. This is because the only receptors covered in the operational assessment

are users of the reprovided public open space within Crossfield Street Open Space. While there are developments that would increase the population within the catchment area for the new open space, none of the developments would affect the sensitivity of public open space users as a receptor.

Assumptions and limitations

10.3.12 The assumptions and limitations associated with this assessment are presented in Volume 2.

Assumptions

10.3.13 It is assumed that the resulting redesigned and landscaped open space in the operational phase would represent an improvement to the existing condition of the space.

Limitations

10.3.14 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, including a description of the local social and economic context, and a description of the receptors relevant to this assessment. Future baseline conditions (base case) are also described.

Local context

10.4.2 The immediate (within 250m) and wider (within 1km) local areas surrounding the site comprise a mix of residential and commercial uses, and a range of community facilities (as shown in Vol 23 Figure 2.1.2, see separate volume of figures). The closest residential areas are located to the south and east of the site. Of the commercial land uses, industrial premises are located to the south of the site under the railway arches, and east of the site along the banks of Deptford Creek, while Deptford High Street is located to the west. The local area is also a hub for community facilities including St Paul's Church, schools, leisure centres, libraries and creative arts spaces and studios. This includes new facilities accommodated within and adjoining the Giffin Street Regeneration Area, which includes the new site for Tidemill Primary School (LB of Lewisham, 2010)[2], which is located 50m beyond a railway viaduct, adjacent to the Wavelengths Leisure Centre and Library. A network of open spaces is also located within 250m of the site.

Community profile

10.4.3 A detailed community profile is outlined in Vol 23 Appendix H.1[iii]. The following points provide a summary of the profile and provide context to this socio-economic assessment:

[iii] Information sources are provided in the appendix.

a. The resident population was approximately 2,225 within 250m of the site and approximately 27,650 within 1km of the site at the time of the last census for which data is available[iv].

b. The proportion of under 16 year olds within 250m of the site (23.9%) and 1km (21.0%), as well as at a borough-wide level (21.1%) are broadly in line with the Greater London average (20.2%).

c. The proportion of over 65 year olds within 250m of the site (6.9%) is considerably lower than within 1km (8.9%) at a borough level (11.0%) and Greater London (12.4%).

d. Within 250m of the site, White residents make up approximately half of the population (49.8%) with Black Minority and Ethnic (BME) groups making up the remaining 50.2% residents.

e. Within 250m, the proportion of Black residents (34.4%) is slightly higher than within 1km (26.8%) and considerably higher than the Greater London average (10.9%). By contrast, the proportion of Asian residents within 250m (4.7%) and 1km (4.8%) is considerably lower than the Greater London average (12.1%).

f. Within 250m of the site, the proportion of residents suffering from long term limiting illness (14.1%) is slightly lower than the proportion within 1km (14.4%), London Borough (LB) of Lewisham (15.6%) and Greater London (15.5%). The proportion of residents who claim disability living allowance within 250m (5.2%) and 1km (5.0%) of the site and within the LB of Lewisham (5.2%) is slightly higher than Greater London level (4.5%).

g. General health in the local areas within which the site is located is relatively poor, with low life expectancy, relatively high death rates from serious illness, and high rates of adult and child obesity relative to Greater London. While there is a moderate instance of adults undertaking physical exercise, children in the borough rank low relative to the rest of Greater London in terms of undertaking physical activity.

h. Almost two thirds of households within 250m of the site do not own cars (60.7%) in contrast to Greater London where it is a little over one third of all households (37.5%). There is a significant incidence of deprivation within 250m of the site, with levels of income deprivation and overall deprivation (both 79.0%) being approximately three times as high as the Greater London average (30.8% and 24.5% respectively).

10.4.4 The above community profile suggests that the local community is diverse with an above average number of Black residents in particular. The community experiences generally poor health and low life expectancy. Most residents experience high levels of income and overall deprivation in comparison to Greater London, particularly within 250m of the site.

[iv] Census 2001. This type of data for the 2011 Census had not been released at the time of the assessment.

Economic profile

10.4.5 A local economic profile (based on 2012 data) is outlined in Vol 23 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 3,000 jobs and 400 businesses.[v]

b. The three leading sectors as measured by employment within approximately 250m are: Wholesale and Retail Trade; Administrative and Support Services; and Other Service Activities.

c. The three leading sectors as measured by number of businesses within approximately 250m are: Wholesale and Retail Trade; Administrative and Support Services; and Professional, Scientific and Technical Activities.

d. At all geographical levels, most businesses fall within the smallest size band (1 to 9 employees), with the proportion of these within 250m closely reflecting the proportions recorded for both the borough and Greater London.

e. Across each of the leading sectors measured by employment and number of businesses within 250m, the majority of businesses are of the smallest size band (employing 1 to 9 employees). The Administrative and Support Service Activities is an exception, with 24% of businesses employing 10 or more employees.

Receptors

Public open space – Crossfield Street Open Space

10.4.6 The site falls within an area of public open space known as Crossfield Street Open Space. The open space is bounded by Coffey Street to the north, Deptford Church Street to the east, and Crossfield Street to the south and west.

10.4.7 The open space is approximately 0.6ha in size and categorised as a 'pocket park' under the GLA Open Space Hierarchy meaning that it would typically serve a catchment of less than 400m (GLA 2011)[3]. The LB of Lewisham Leisure and Open Space Study identifies the space as being an area of "*visual amenity greenspace - areas that improve the visual appearance of residential or other areas*" (LB of Lewisham, 2010)[4]. The study assesses the open space as being of "average" quality (35%). At this level it falls below the proposed quality standard for amenity greenspace set in the study (46%).

[v] Source: Experian 2012. Data is aggregated for seven digit post-code units falling wholly or partially within a 250m of the 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.

10.4.8 The open space is divided into two portions by a high brick wall which cuts across the site from north to south so that it does not function as a single space. Both sections are accessible to the public at all times. The space is not formally landscaped although it is planted with a number of semi-mature and mature trees.

10.4.9 The open space provides opportunities for both passive recreation and small scale informal active recreation; however there are no visitor amenities such as benches or lighting. Both halves of the open space are overlooked by small industrial units located within or adjacent to the arches of the railway viaduct to the immediate south.

10.4.10 The western section of the open space is bounded by a low perimeter fence, approximately half a metre high, separating the site from the pedestrian walkway. It is designated by St Joseph's Roman Catholic (RC) Primary School as a mustering point.

10.4.11 The eastern section of the open space is bounded by an approximately 1.5m high ornamental palisade perimeter fence with an access gate on Crossfield Street. The space is suited to dog exercising due to the fencing that encloses it. This section's proximity to Deptford Church Street (A2209) means that it experiences greater exposure to traffic.

10.4.12 Vol 23 Figure 10.4.1 (see separate volume of figures) shows the location of this receptor.

10.4.13 The usage surveys (see Vol 23 Appendix H.3) found that both sections were lightly used. The vast majority of users recorded (over 80%) used the space for walking and exercising dogs, and then almost always within the fenced off eastern portion of the space. The western portion of the space was rarely recorded in use and then usually by pedestrians traversing between the adjacent carriageways. Three instances of passive recreational use of the western portion of the space were recorded during the surveys.

10.4.14 The main factor affecting the sensitivity of the users of Crossfield Street Open Space to the impacts from the proposed development is the availability of alternative open spaces. Relevant considerations to this are:

a. There are several other open spaces within 400m of the Crossfield Street Open Space to the north and east. These are (see next sub-section for further details on these spaces):

   i St Paul's Churchyard (within the churchyard walls) to the north – usually made available to public access (at the discretion of the church) and providing predominantly for quiet passive recreation

   ii A lawn to the east of St Paul's Churchyard's walls at the junction with Deptford Church Street and Coffey Street – fenced and available for dog walking and other uses comparable to Crossfield Street Open Space

   iii Sue Godfrey Local Nature Reserve to the east beyond Deptford Church Street, set aside for grassland and nature conservation and which contains some seating and the adjoining Ferranti Park,

which contains seating, a bandstand style shelter and a child playground area

iv A small playground to the north of the St Paul's Church churchyard at Mary Ann Buildings, providing for children's play

b. The alternative spaces are each of similar size and, based on the LB Lewisham's open space study (2010)4, are of better quality than the Crossfield Street Open Space. They do not allow for completely the same recreational opportunities, as they have slightly different functions. The church yard is intended for passive recreation and signage at the Sue Godfrey nature reserve forbids the exercising of dogs. The lawn to the east of St Paul's Churchyard does however provide an alternative suitable space for dog exercising and passive recreation.

10.4.15 Taking the above factors into account, it is concluded that the sensitivity of users to the temporary loss of use of Crossfield Street Open space is medium.

Public open space – St Paul's Churchyard, Sue Godfrey Local Nature Reserve and Ferranti Park

10.4.16 St Paul's Churchyard, located north of the site, is approximately 0.9ha in size. The space is clearly divided by an approximately 2m high wall into two portions, as follows:

a. St Paul's Churchyard (within the churchyard walls) to the north and west.

b. A lawn to the east of the churchyard walls at the junction with Deptford Church Street and Coffey Street.

10.4.17 The churchyard contains formal gardens and areas for passive recreation. It contains pathways providing access to the church itself, as well as a thoroughfare between Deptford High Street and Deptford Church Street. It is mostly surrounded by high stone or brick walls, particularly to the south and the north. In the borough's open space study it was afforded a quality rating of "very good" (66%) (LB of Lewisham, 2010).

10.4.18 The area of lawn to the east of the churchyard wall is slightly smaller than the eastern half of the Crossfield Street Open Space. It is of very similar quality and character to the eastern portion of Crossfield Street Open Space, being located adjacent to Deptford Church Street, fenced and informally planted with trees.

10.4.19 The usage surveys of these spaces (see Vol 23 Appendix H.3) found that the two distinct sections of the space were both generally lightly used during both weekdays and weekends. An exception to this was during morning and evening travel peaks when the churchyard experienced increased levels of usage as a thoroughfare. In the case of the churchyard most users were either walking through or making use of the benches for seating. The lawn east of the walls was lightly used for dog exercising or sitting down.

10.4.20 The Sue Godfrey Local Nature Reserve, to the east of the site across the A2209 Deptford Church Street (dual carriageway) is a 0.6ha area of semi-natural greenspace. The nature reserve primarily supports flora and fauna rather than being a dedicated recreational resource. Ferranti Park is located adjacent to the east of this nature reserve. Designed and constructed in 2005, Ferranti Park contains a pavilion, seating areas and playground.

10.4.21 The local authority notes that the use of the nature reserve by people and dogs has increased recently owing to new residential development to the north of the site at Berthon Street (LB of Lewisham)[5]. Together with the open spaces surrounding St Paul's Church (including on the north side of the churchyard alongside Mary Ann Buildings) and the grounds of the Trinity Laban Conservatoire of Music and Dance situated to the east, this nature park provides a continuous 'green' link between Deptford High Street and Creekside. In terms of quality, the borough's open space study in 2010 assessed the Sue Godfrey Local Nature Reserve as "good" (51%) (LB of Lewisham, 2010).

10.4.22 The usage surveys of these spaces (see Vol 23 Appendix H.3) found that both were generally lightly used during both weekdays and weekends. Ferranti Park was more heavily used than the nature reserve, with some more prolonged periods of use observed at the playground and by youths engaging in passive recreation.

10.4.23 Vol 23 Figure 10.4.1 (see separate volume of figures) shows the location of this receptor.

10.4.24 The main factor affecting the sensitivity of the users of the spaces above to any impacts from the proposed development is the availability of alternative open spaces providing passive or active recreation within 400m of these open spaces. These are limited but include:

a. A children's playground to the north of St Paul's Churchyard (alongside Mary Ann Buildings).

b. Charlotte Turner Gardens - an open space to the north of Creek Road / McMillan Street.

c. There are also the grounds of the Trinity Laban Conservatoire of Music and Dance beyond Creekside, although they are not technically classed as public open space, despite being open to public access at most times when surveying was undertaken.

10.4.25 Taking the above factors into account, it is concluded that the sensitivity of users of these open spaces to any reduction in amenity is considered to be medium.

Residential

10.4.26 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.

10.4.27 Land that is predominantly used for residential development is shown in the land use plan for this site, Vol 23 Figure 2.1.2 (see separate volume of figures).

10.4.28 It is considered that the sensitivity of nearby residents to overall amenity effects would vary by time of day, with residents being less sensitive to amenity effects, particularly noise, during the day and more sensitive to such effects during the evening and night.

10.4.29 Therefore, as outlined in the methodology for this socio-economic impact assessment (see Volume 2) the sensitivity of nearby residential receptors to amenity impacts would be medium during the day and high during the evening and night.

Education facilities – St Joseph's RC Primary School and Tidemill Academy

10.4.30 There are two schools in the area surrounding the site. These are:

a. St Joseph's RC Primary School - a Voluntary Aided School in the Archdiocese of Southwark. According to the Department for Education there were 233 pupils on roll in May 2012, against a capacity of 288 places[6]. It caters for children aged 4 to 11, and there are no early years or nursery classes at the school.

b. Tidemill Academy - a former primary school which gained academy status in 2011 and will be relocating to new premises in autumn 2012[7]. According to the Department for Education there were 417 pupils on roll in May 2012, against a capacity of 420 places[8]. It caters for children aged 4 to 11, and has a nursery class at the school.

10.4.31 St Joseph's RC Primary School is located to the west of the proposed construction site and is separated from the site by Crossfield Street, which at this end of the street is a public footpath rather than a vehicle route. The school does not contain any open green space within its premises, although there is yard space used for outdoor activities.

10.4.32 A child drop off and pick up zone for use by vehicles is located in the northwest corner of the site at the junction of Crossfield Street and Coffey Street, although as Crossfield Street is closed off, this vehicle zone is solely accessed via Coffey Street (from Deptford Church Street).

10.4.33 Tidemill Academy's new premises are located to the south of the proposed construction site and lies beyond the railway lines on Giffin Street. The school contains green space used for sports facilities and yard space used for outdoor activities.

10.4.34 Vol 23 Figure 10.4.1 (see separate volume of figures) shows the location of these receptors.

10.4.35 Overall, children are generally considered to be more sensitive in comparison to adults to certain amenity related impacts, particularly with regard to effects on their learning capabilities related to noise from sources such as road traffic (Department of Transport, undated)[9] and to effects on health arising from air pollution (GLA, 2007)[10]. With regard to visual impacts, it is considered that children are likely to be focused on the

internal learning environment rather than the external views from the classroom when indoors.

10.4.36 At St Joseph's RC Primary School, there is a section of 2m solid brick wall between the school and the footpath which provides screening from the site, although the wall is not continuous along the entire boundary. Tidemill Academy has a completely obscured view of the site, and at its closest point is approximately 60m from the site.

10.4.37 Taking account of the above factors, it is considered that pupils and employees of the schools would have a medium level of sensitivity to amenity impacts.

Place of worship – St Paul's Church

10.4.38 St Paul's Church, a Grade I listed structure, is an important local landmark which is used for various community activities. It is located north of the site within the churchyard beyond Coffey Street, mostly surrounded by high stone walls.

10.4.39 Vol 23 Figure 10.4.1 (see separate volume of figures) shows the location of this receptor.

10.4.40 The main factors affecting the sensitivity of the church to any impacts or changes which would be brought about by the proposed development are:

a. Users of the church would have limited opportunities to relocate to avoid any amenity impacts, if they were to occur.

b. The church is likely to be used at varying times of the week, including regularly as a place of worship (eg, for Sunday services), as well as for other activities (administrative activities, group activities, etc), services and ceremonies at other times of the week.

c. Regarding activities taking place there, the church has been a base for St Paul's Sinfonia chamber orchestra until recently. It is understood from the website that the chamber orchestra ended its association with the church in October 2011[11]. However the church still has potential to accommodate or host concerts, choral groups, professional recordings or other income generating activities.

10.4.41 Taking the above factors into account, it is considered that the sensitivity of the staff, congregation and other users of the church is medium.

Summary

10.4.42 A summary of receptors as described in the baseline and their sensitivity is provided in Vol 23 Table 10.4.1.

Vol 23 Table 10.4.1 Socio-economics – receptor values / sensitivities

Receptor	Value / sensitivity and justification
Users of public open space – Crossfield Street Open Space	Medium – there are several alternative open spaces of larger size and better quality in the surrounding area, however they are not all able to provide for completely similar

Receptor	Value / sensitivity and justification
	recreational opportunities.
Users of open space – St Paul's Churchyard, the Sue Godfrey Local Nature Reserve and Ferranti Park	Medium – the layout of the spaces relative to the proposed development and the existing of other alternative open spaces a short distance away from the site would reduce users' sensitivity.
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.
Education facility – St Joseph's RC Primary School and Tidemill Academy	Medium – pupils and staff would have limited opportunity to avoid effects, however they are less exposed to certain impacts when indoors.
Place of worship – St Paul's Church	Medium – partially screened by high masonry stone walling; church hosts a range of community based uses at various times of the week, including Sundays when no construction work is proposed.

Construction base case

10.4.43 The construction assessment year and area are as set out in para. 10.3.3.

10.4.44 The base case in the peak year of construction, taking into account the schemes described in Section 10.3, would differ from the baseline in the following ways:

a. It would include additional residential receptors that would 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.

10.4.45 There may be changes in the number and type of businesses located at the site and in the surrounding area, eg, businesses may open or close. It is not possible however to forecast this with accuracy.

10.4.46 Other than the above matters, it is assumed that the base case socio-economic conditions at the site would remain largely the same as the existing baseline condition.

Operational base case

10.4.47 The operational assessment year and area are as set out in para. 10.3.8. The base case in Site Year 1 of operation taking into account the schemes

described in Section 10.3 would not change beyond that set out for the construction base case above.

10.5 Construction effects assessment

Temporary closure of open space – Crossfield Street Open Space

10.5.1 The construction works would result in the temporary cordoning off and closure of the Crossfield Street Open Space. As a result, there would be a temporary loss of use of approximately 0.4ha of public open space.

10.5.2 The magnitude of the impact is influenced by the following factors:

a. Temporary closure of the space would result in a loss of opportunities for passive recreation at this location, such as sitting on the grass and dog exercising, and the displacement of such activities to other open space areas.

b. Given the usage survey findings (see Vol 23 Appendix H.3) the number of users that would be impacted is likely to be low and would include impact on those exercising dogs in the eastern portion of the open space.

c. Temporary closure of the open space would also result in the temporary loss of the space to use by St Joseph's RC Primary School children as a fire assembly point, however an alternative assembly point has been identified for the school children (see Section 3.4 of this volume).

d. The temporary closure would last approximately three and a half years, constituting a medium term impact.

e. Alternative, larger open spaces of a higher quality exist within a short distance at, and to the north of, St Paul's Churchyard and within the Sue Godfrey Local Nature Reserve and Ferranti Park to the east. These alternatives are likely to be favoured by people seeking out open spaces for passive recreation. The exceptions may be for dog exercisers who may be able to use space within St Paul's Churchyard immediately to the north.

10.5.3 Taking account of the above factors, in particular the results of the usage surveys, the impact magnitude arising from the temporary loss of open space at the site is likely to be low.

10.5.4 Given the low magnitude of the impact and the medium sensitivity of park users, it is considered that there would be a **minor adverse** effect on open space users.

Effect on the amenity of open space (St Paul's Churchyard, Sue Godfrey Local Nature Reserve and Ferranti Park) users

10.5.5 Assessments have been undertaken to examine the likelihood of significant air quality, noise and vibration, and visual effects of the project arising during construction. For further information refer to the respective construction effects sections within this volume (see 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 the nearby public open spaces:

a. Local air quality effects would be **negligible** and construction dust effects would be **minor adverse** at Sue Godfrey Nature Reserve. Both local air quality and construction dust effects would be **negligible** at both St Paul's Church (assessed as a place of worship) and the playground to the north of St Paul's Churchyard.

b. No noise and vibration receptors were identified as requiring assessment in relation to the public open spaces at this site.

c. Visual effects would be **minor adverse** from viewpoint 2.2 (Ferranti Park) for the duration of the construction period. It was assessed that visual effects would be **major adverse** from the steps of the church (viewpoint 2.1).

10.5.6 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 receptor's overall experience of amenity at this site:

a. Given the three and a half year construction programme, the effects noted above would be likely to be experienced over a medium term period.

b. The visual effects findings demonstrate that the layout of the site and the respective open spaces nearby would affect the way in which different open space users experienced the visual impacts. For example, the churchyard and the Sue Godfrey Local Nature Reserve contain areas that are varying distances from the site and / or are separated from the site by high walls (in the case of the churchyard). Although it is close to the site, Sue Godfrey Local Nature Reserve is separated from the site by a relatively busy road (Deptford Church Street). Ferranti Park is located approximately 150m from the site and partially screened by a wall on its southwestern side and vegetation within the nature reserve.

c. Due to the layout of the surrounding open space, together with the relatively low usage of the open spaces (with the partial exception of Ferranti Park) observed during usage surveys (see Vol 23 Appendix H.3), any adverse amenity impacts would only affect a small number of users.

d. Although the visual impact assessment identified a major adverse effect, this was taken from an elevated position in the churchyard and would not be typical of most users' views given the churchyard's layout, with the exception of views of cranes within the construction site. Given the existing nature of the open spaces and their respective uses, such as dog walking, it is not considered that the adverse visual effects would substantially compromise the uses that were observed to taking place within the various public open spaces.

10.5.7 Taking account of the above findings and factors, it is considered that the impact magnitude would be low.

10.5.8 Given the low impact magnitude and the medium sensitivity of open space users, it is considered that the effect on the amenity of open space users would be **minor adverse**.

Effect on the amenity of residents

10.5.9 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 residential receptors:

a. Local air quality effects would be **minor adverse** at one receptor (Giffin St Regeneration area) and **negligible** at the remaining three receptors identified. Construction dust effects would be **minor adverse** at one receptor (Berthon Street) and **negligible** at the other three residential receptors.

b. Noise effects would be **not significant** at all of the five residential receptors identified during the day or the evening. No assessment is made of effects during the night, as works during the night are not likely at this site. In regard to road-based construction traffic, the noise assessment found that the change in noise level due to construction traffic is considered to be **not significant**. Vibration (human response) effects would be **not significant** at any of the residential receptors identified.

c. Visual effects would be **major adverse** from two of the five residential viewpoints (1.1 and 1.5), **moderate adverse** at two further viewpoints (1.3 and 1.4) and **minor adverse** at the remaining viewpoint (1.2).

10.5.10 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 three and a half year construction programme, the effects noted above would be likely to be experienced over a medium term period. An exception is that local air quality may not be minor adverse over the whole construction period as the assessment is based on the peak construction year and this effect may be negligible in other years.

b. While it is estimated that there would be major or moderate adverse visual effects at four viewpoints, in part because of the loss of trees within certain views, 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 these viewpoints would also have views in other directions that are either not as severely affected or not affected at all.

c. Additionally, due to the layout of the streets, buildings and railway viaduct surrounding the site, as well as the varying proximity and orientation of nearby residential buildings relative to the site, the experience of visual effects would not be uniform at all nearby

residential receptors, as reflected in the findings of the respective assessments presented above.

10.5.11 Taking account of the above findings and factors, in particular the absence of any significant air quality, construction dust, noise and vibration effects, it is considered that of the overall amenity impact magnitude would be low.

10.5.12 Given the low impact magnitude and the medium sensitivity of residents during the day, it is considered that the effect on the amenity of a limited number of residential receptors located closest to the site would be **minor adverse**.

10.5.13 This assessment relates primarily to those residential receptors that would experience adverse local air quality or construction dust and adverse visual effects. For residential receptors not subject to these effects, it is considered that there would be a negligible effect on residential amenity.

10.5.14 As there are no significant noise effects during the evening, it is considered that the effect would remain the same as during the day on those occasions when construction work takes place in the evening.

Effect on the amenity of staff and pupils at St Joseph's RC Primary School and Tidemill Academy

10.5.15 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 St Joseph's RC Primary School and Tidemill Academy:

a. Local air quality effects would be **negligible** at St Joseph's RC Primary School playground and **minor adverse** at St Joseph's RC Primary School building. Construction dust effects would be **minor adverse** at St Joseph's RC Primary School playground and building. Local air quality and construction dust effects would both be **negligible** at Tidemill Academy.

b. Noise effects are considered to be **significant** at St Joseph's RC Primary School[vi]. Noise effects would be **not significant** at Tidemill Academy. Vibration (human response) effects would be **not significant** at either school.

c. No visual receptors were identified as requiring assessment in relation to any schools near this site.

10.5.16 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:

[vi] Predicted average noise levels are not expected to exceed guideline noise levels for classroom use but there remains a risk that for shorter durations the guidance level could be exceeded and effects would therefore be significant.

a. While there would be an approximately three and a half year construction programme at this site, the effects noted above may only be experienced for a short term, rather than a medium term period. This is because:

   i For local air quality, the effects may not be minor adverse over the whole construction period as the assessment is based on the peak construction year and these effects may be negligible in other years.

   ii For noise, the assessment result is based on an estimated noise exceedance during the day; the worst effects of which would apply over a short term period (ie, less than one year).

b. If noise levels did exceed the ambient noise level, as per the identified risk within the noise assessment, then there would be effects on the classroom learning environment.

10.5.17 Taking account of the above findings and factors, it is considered that of the overall amenity impact magnitude would be medium.

10.5.18 Given the medium impact magnitude and the medium sensitivity, the effect on the amenity of staff and pupils at St Joseph's RC Primary School would be **moderate adverse**.

10.5.19 It is noted that the air quality, construction dust, noise, vibration, and visual effect assessment did not conclude that there would be any significant effect on Tidemill Primary School. Therefore, the effect on the amenity of staff and pupils at Tidemill Academy would be **negligible**.

10.5.20 With regard to the potential effect on St Joseph's RC Primary School, these findings present a worst case scenario, which is particularly due to the effect on the school as a result of noise impacts. The noise levels have been predicted for the upper floor of the main school building and it states that it considers this part of the school to be subject to the highest construction noise levels. The assessment also considers the temporary classrooms located in the playground. It states that whilst they are closer to the site, they are fully screened by the site hoarding. If no significant noise effect occurs, the effect on the amenity of the school would be lower.

Effect on the amenity of St Paul's Church and its users

10.5.21 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 St Paul's Church:

a. Local air quality effects and construction dust effects would be **negligible**.

b. Noise effects would be **significant** at St Paul's Church. This finding is informed in part by the estimate that the predicted noise levels would exceed the ambient noise level for 25 months, although the worst-

case predicted noise level during the day would be greater than the current ambient noise level for seven months in total. During the 25 month period, the average noise level inside the church is expected to exceed guideline noise levels (for 8 months) based on typical noise insulation for a façade of this type. No exceedance during the evening is estimated. Vibration (human response) effects would be **not significant**.

c. Visual effects would be **major adverse** from the viewpoint identified on the steps of St Paul's Church (viewpoint 2.1).

10.5.22 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 three and a half year construction programme, the effects noted above would be likely to be experienced over a medium term period. Although the noise exceedance giving rise to significant noise effects on St Pauls is not predicted to occur for the entire construction period, it would still occur for a medium term period.

b. It is noted that the visual assessment has been made from one particular viewpoint, ie, from the steps of the church looking to the south, and that views in other directions and from other vantage points would be less affected or not affected at all. In particular, the high masonry wall bordering the church yard on its southern side would help to limit views of the construction site and activity from ground level within the church yard. Additionally, such views would not impact on people within the church and so this assessment considers that visual impacts would be unlikely to affect users of the church at most times. As such, it is not considered likely that visual impacts would act as a substantial deterrent to people visiting the church, even though they may have to pass the construction site on their way to the church.

c. Potentially affected people would include both members of the congregation and regular users attending the church for other activities. It is noted that the noise exceedances and other effects could curtail the church's capacity to accommodate professional recordings or host other income generating activities such as choral groups, concerts and weddings.

d. However it should be noted that given the proposed working hours at the site (see Section 3.3 of this volume), while weekday users of the church would be potentially exposed to amenity impacts arising during working hours, evening, Saturday afternoon and Sunday users of the church would typically not be exposed to such impacts, except during occasional periods of standard extended working hours (weekday evenings).

10.5.23 It is considered possible that the church would incur a financial loss during construction due to perceived and actual drop in amenity and the consequent reduction in bookings at the church by choir groups or for weddings, funerals or other events.

10.5.24 Taking account of the above findings and factors, including the potential impact on church activities due to noise effects, it is considered that the impact magnitude would be medium.

10.5.25 Given the medium impact magnitude and the medium sensitivity, it is considered that the effect on the amenity of St Paul's Church and its users would be **moderate adverse**.

10.5.26 These findings present a peak year scenario, which is particularly due to the effect on the church as a result of noise impacts. The extent to which noise effects actually affect activities would depend on the number of activities that take place in the church during the main construction hours. Outside of this period, it is considered that the effect significance on the amenity of the church would be minor adverse (on the basis of a medium sensitivity and a low magnitude of impact).

10.6 Operational effects assessment

Landscape changes to the layout and design of Crossfield Street Open Space

10.6.1 The project would work with the local authority and local stakeholders on the detailed design of the landscaping scheme for the park. It is assumed that the redesign of the space would result in an improvement to the condition of the public open space.

10.6.2 The magnitude of the impact would be influenced by the following factors:

a. Although provision for access would be required for maintenance purposes, public access to the open space area would be otherwise be restored.

b. The impact would be permanent.

c. Given that the project would work with local stakeholders on the design of the landscaping scheme to be constructed, it is assumed that the resulting redesigned and landscaped open space would represent a significant improvement on the existing condition of the space. In addition, it is also likely to enable the open space to provide for a more varied range of recreational activities, as well reprovision of the school fire assembly and emergency mustering point for St Joseph's RC Primary School.

d. It is expected that this would lead to an appreciable increase in the number of people using, and benefitting from, the redesigned space, thereby leading to a step change in the way it is used and the intensity of that new use by the local community.

10.6.3 Taking account of the above factors, the impact magnitude would be medium.

10.6.4 Given the medium impact magnitude and the low sensitivity of users of Crossfield Street Open Space, it is considered that the effect on open space users' amenity would be **minor beneficial**.

10.7 Cumulative effects assessment

Construction

10.7.1 For the purposes of this cumulative assessment, the assessment year is the peak construction year.

10.7.2 As described in Section 10.3, Giffin Street Regeneration Area and Creekside Village East would be under construction during the peak construction year.

10.7.3 In respect to the assessment undertaken in Section 10.5 relating to temporary closure of Crossfield Street Open Space, as these developments are not located within the Limit of land to be acquired or used (LLAU), they would not give rise to any cumulative effects.

10.7.4 In respect to the assessments undertaken in Section 10.5 relating to amenity effects, the two developments are located within the 250m assessment area for such effects and so they could give rise to cumulative effects on the amenity of potentially sensitive receptors such as residents, public open space users, the schools and St Paul's Church. The air quality and construction dust cumulative effect assessment (see Section 4.7 of this volume) has concluded that air quality effects arising as a result of the Creekside Village East development would be likely to be small and would not affect the significance of the impact. The noise and vibration effect assessment (see Section 9.7) concludes that effects on receptors would remain as described in Section 9.5. The visual effect assessment (see Section 11.7) has concluded that construction activity associated with the Giffin Street Regeneration Area together with construction at the Thames Tideway Tunnel site would elevate effects on viewpoint 1.4 and that the already significant effects would be elevated to a limited extent.

10.7.5 Therefore, it is considered that while visual effects may be elevated to a limited extent at one viewpoint, that the developments would not affect the significance of the effect on the amenity of sensitive receptors considered in the construction effects assessment in Section 10.5.

10.7.6 Therefore, the effects would remain as described in Section 10.5.

Operation

10.7.7 Of the projects described in the site development schedule (Vol 23 Appendix N), none are proposed to be under construction during Site Year 1 of operation, so a cumulative effects assessment has not been undertaken.

10.7.8 Therefore, the effects would remain as described in Section 10.6.

10.8 Mitigation and compensation

Mitigation

Construction

10.8.1 The above assessment has concluded that there is a potential for a moderate adverse effect to arise in relation to amenity impacts on St Joseph's RC Primary School and St Paul's Church.

10.8.2 The assessment relating to amenity effects is based on the residual findings of the air quality, construction dust, noise, vibration (human response) and visual effect assessments. Where practicable and applicable, embedded measures have been included and no further practicable measures can be adopted above those 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.

Operation

10.8.4 The above assessment has concluded that operational effects would be beneficial and therefore mitigation is not needed.

Compensation

Construction

10.8.5 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.

10.8.6 In relation to the effects on St Joseph's RC Primary School, the programme measures are not considered to be mitigation as there is no guarantee that the receptor in question would be eligible for compensation or that they would be accepted by the affected party and therefore the residual effects reported in this *Environmental Statement* do not 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 this application).

10.8.7 In relation to the effects on the St Paul's Church (see para. 10.5.23 to para. 10.5.26), the church could submit a claim for compensation in accordance with the Thames Tideway Tunnel compensation programme. The programme measures are considered to be mitigation. Therefore the residual effects reported in this *Environmental Statement* 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

Construction

10.9.1 In relation to St Joseph's RC Primary School, 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 the school would remain as described in Section 10.5.

10.9.2 In relation to St Paul's Church, as compensation is considered to mitigate (ie, reduce) the significant adverse effect, the effect due to construction activity would be rated as **minor adverse**.

10.9.3 All residual effects are presented in Section 10.10.

Operation

10.9.4 As no mitigation measures are proposed, the residual operational effects remain as described in Section 10.6. All residual effects are presented in Section 10.10.

10.10 Assessment summary

Construction

Vol 23 Table 10.10.1 Socio-economics – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect	Compensation
Users of public open space – Crossfield Street Open Space	Temporary closure of open space – Crossfield Street Open Space	Minor adverse	None	Minor adverse	
Users of open space – St Paul's Churchyard, Sue Godfrey Local Nature Reserve and Ferranti Park	Effect on the amenity of users of St Paul's Churchyard, Sue Godfrey Local Nature Reserve and Ferranti Park	Minor adverse	None	Minor adverse	
Residents	Effect on the amenity of residents	Minor adverse	None	Minor adverse	
Education facility – St Joseph's RC Primary School	Effect on the amenity of staff and pupils of St Joseph's RC Primary School	Moderate adverse	No further mitigation practicable*	Moderate adverse	Compensation mechanisms available for amenity related disturbance during the construction phase
Education facility – Tidemill Academy	Effect on the amenity of staff and pupils of Tidemill Academy	Negligible	None	Negligible	
Place of worship – St Paul's Church	Effect on the amenity of St Paul's Church and	Moderate adverse	Compensation measures	Minor adverse	As described under Mitigation column.

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect	Compensation
	its users		available for amenity related disturbance during the construction phase*		

**Compensation may be available for both the church and the school however for the purpose of the assessment compensation is counted as mitigation for the church only (see Section 10.8 and Vol 2 Section 3.2.10)*

Operation

Vol 23 Table 10.10.2 Socio-economics – summary of operation assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Users of Crossfield Street Open Space	Landscape changes to the layout and design of Crossfield Street Open Space	Minor beneficial	None	Minor beneficial

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 11: Townscape and visual

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

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Thames Tideway Tunnel

Environmental Statement

Volume 23: Deptford Church Street 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 Deptford Church Street. Construction activities at the Deptford Church Street highway works sites would be small scale in nature and would not give rise to significant townscape and visual effects. Therefore the findings of the assessment presented here relate to the main site only. 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. 11.3.11 for construction and para. 11.3.19 for operation).

11.1.4 Each section of the assessment is structured with townscape aspects 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[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 23 Deptford Church Street Figures).

11.1.7 A separate but related assessment of effects on the setting of heritage assets is included in Section 7 of this volume.

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. clearance of existing trees and the wall running through the site

b. use of cranes during shaft sinking

c. provision of welfare facilities, assumed to be a maximum of three storeys in height

d. installation of 3.6m high hoardings around the boundary of the construction site

e. vehicular construction access to the site off Crossfield Street, Coffey Street and Deptford Church Street.

Code of construction practice

11.2.3 Measures incorporated into the Code of construction practice (CoCP) Part A to reduce townscape and visual impacts include:

a. the use of well-designed visually attractive hoardings

b. protection of existing trees, where possible, in accordance with *BS5837 'Trees in Relation to Construction – Recommendations'*

c. the use of appropriate capped and directional lighting when required.

11.2.4 Measures incorporated into the *Code of construction practice* (*CoCP*) Part B to reduce townscape and visual impacts include:

a. use of climbing plants along the public facing sections of hoarding

b. use of 3.6m high hoardings

c. use of dark green painted welfare facilities to tie in with the character of the open space and the planted hoardings.

Operation

11.2.5 The particular components of importance to this topic include the:

a. design, layout and materials used in the public realm including the treatment of planting, seating, boundaries and lighting

b. treatment of access hatches within the public realm

c. design, siting and materials used for the ventilation columns and electrical 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 (Volume 23 Deptford Church Street Figures). Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint in Section 11.6.

11.2.7 Measures which have been incorporated into the design of the proposed development (refer to the *Design Principles* report in Vol 1 Appendix B) include:

a. the design would enhance appreciation of the Grade I listed St Paul's Church by providing a more integrated and accessible public space

b. replacing at least the same number of trees lost with native species in keeping with the character of the new open space

c. the extent of hard standing within the site boundary would be reduced as far as possible

d. the use of paving materials that relate to the surrounding townscape character

e. locating the ventilation columns towards the south of the site, furthest from the Grade I listed St Paul's Church

f. locating the electrical and control kiosks towards the edge of the open space to maximise the amount of public realm and avoiding obscuring local views towards the St Paul's Church

g. a commitment to a high quality design for the ventilation columns

h. incorporating a brown roof onto the electrical and control kiosks

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 The London Borough (LB) of Lewisham, neighbouring authority the Royal Borough (RB) of Greenwich and English Heritage have been consulted on the detailed approach to the townscape and visual assessment, including the number and location of viewpoints. English Heritage (May 2011) have confirmed acceptance of the proposed viewpoints. The LB of Lewisham and the RB of Greenwich have not commented on the proposed viewpoints.

11.3.3 In March and April 2011, English Heritage were consulted on the scope of the townscape and visual assessment through a site visit. English Heritage provided feedback on the proposed design of the site and potential impacts during construction. English Heritage also indicated their

agreement of the proposed visual assessment viewpoints prior to their formal acceptance (described in para. 11.3.2 above).

11.3.4 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 (July 2012) confirmed acceptance of the proposed changes and also requested an additional photomontage from the corner of Deptford Church Street and Bronze Street. On the basis that this photomontage would provide a very similar illustration to the one prepared for viewpoint 1.1, one has not been produced for this proposed location. The RB of Greenwich and English Heritage have not commented on the proposed changes.

11.3.5 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.

Baseline

11.3.6 The baseline methodology follows the methodology described in Vol 2. 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 (August 2011)

b. Photographic survey of townscape character areas (September 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 (December 2011) and verifiable surveying (December 2011) for the viewpoints requiring a photomontage to be produced, as agreed with the stakeholders (described in para. 11.3.2).

11.3.7 With specific reference to the Deptford Church Street site, baseline information on open space distribution and type, conservation areas and townscape character has been gathered through a review of:

a. The Core Strategy for the LB of Lewisham[2]

b. The Unitary Development Plan for the RB Greenwich[3]

c. Deptford Creekside Conservation Area Appraisal[4]

d. The London View Management Framework[5].

Construction

11.3.8 The assessment methodology for the construction phase follows that described in Vol 2. Site specific variations are described below.

11.3.9 With reference to the Deptford Church Street site, the peak construction phase relevant to this topic would be during Site Year 2 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.

11.3.10 Two verifiable photomontages have been prepared for this site to assist the assessment of construction phase effects. These are shown in Vol 23 Figure 11.5.1 and Vol 23 Figure 11.5.2 (see separate volume of figures).

11.3.11 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 hours 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

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.

11.3.12 The assessment area, defined using the methodology provided in Vol 2, is indicated in Vol 23 Figure 11.4.5 for townscape and Vol 23 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 where the construction activity would be barely perceptible. The scale of the visual assessment area has been set by the maximum extent of the construction phase ZTV.

11.3.13 Section 11.5 details the likely significant effects arising from the construction at Deptford Church Street. 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.

11.3.14 For the construction base case for the assessment of effects arising from the proposed development at the Deptford Church Street site, it is assumed that there would be no changes in the base case within the assessment area between 2012 and Site Year 2 of construction as none of the schemes listed in the site development schedule (Appendix N) would fall within the ZTV.

11.3.15 For the purposes of the cumulative effects assessment, it is assumed that the mixed use development located between Giffin Street and Resolution Way (50m to the south of the site) would be under construction during Site Year 2 of construction at the Deptford Church Street site.

11.3.16 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

11.3.17 The assessment methodology for the operational phase follows that described in Vol 2. Any site specific variations are described below.

11.3.18 Two verifiable photomontages have been prepared for this site to assist the assessment of operational effects. These are shown in Vol 23 Figure 11.6.1 and Vol 23 Figure 11.6.2 (see separate volume of figures).

11.3.19 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 substantial lighting requirements apart from reinstatement street lighting. Therefore, no assessment of effects on night time character is made for this site during operation.

11.3.20 The assessment area, defined using the methodology provided in Vol 2, is indicated in Vol 23 Figure 11.4.5 for townscape and Vol 23 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, except in those locations where the proposed development would be barely perceptible. The scale of the visual assessment area has been set by the maximum extent of the operational phase ZTV.

11.3.21 Section 11.6 details the likely significant effects arising from the operation at Deptford Church Street. 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.

11.3.22 In terms of the operational base case for the assessment of effects on Deptford Church Street, it is assumed that the mixed use development to the south of the site located between Giffin Street and Resolution Way (see para. 11.3.15) would be complete and occupied by Year 1 of operation.

11.3.23 As detailed in the site development schedule (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 Deptford Church Street in the operational phase.

11.3.24 As with construction (para. 11.3.16), 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

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

Assumptions

11.3.26 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 the Construction phase plans (see separate volume of figures), with the permanent structures under construction located within the zones shown on the Site works parameter plan.

11.3.27 For the purposes of the operational phase assessment, it is assumed that the above ground structure and areas of hardstanding are in the location shown on the illustrative 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.

Limitations

11.3.28 There are no limitations specific to the assessment of this site.

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 site is located on relatively flat ground within the Deptford Creek valley, with no notable topographic features in the assessment area.

Land use

11.4.4 The site is set within an area to the west of Deptford Creek characterised by a mix of residential properties, small scale retail units along Deptford Church Street to the west of the site and several open spaces. The Grade I listed St Paul's Church is located immediately adjacent to the north of the site and St Joseph's Roman Catholic (RC) Primary School is located to the southwest.

Development patterns and scale

11.4.5 Vol 23 Figure 11.4.1 (see separate volume of figures) illustrates the pattern and scale of development and building heights within the assessment area.

11.4.6 The residential areas surrounding the site are characterised by a mix of residential apartment blocks and semi-detached properties, set amongst a series of open spaces (including the grounds of St Paul's Church) and several schools. Deptford High Street represents a linear band of dense residential and retail terraces to the west of the site, beyond which the pattern of residential development continues.

Vegetation patterns and extents

11.4.7 Vol 23 Figure 11.4.2 (see separate volume of figures) illustrates the pattern and extent of vegetation within the assessment area, including tree cover.

11.4.8 The site is set within a green corridor from Deptford High Street to Deptford Creek, characterised by a relatively high density of mature trees, particularly around St Paul's Church. The density of vegetation decreases amongst the residential development to the north, south and west of the site, although pockets of green spaces are apparent throughout. The residential development to the southeast of the site, between Deptford Church Street and Creekside, is characterised by dense tree cover within communal green spaces, including Sue Godfrey Nature Reserve.

11.4.9 There are no known Tree Preservation Orders (TPOs) within the assessment area, although trees within conservation areas are indirectly protected, which includes the trees within the site.

Open space distribution and type

11.4.10 Vol 23 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.

11.4.11 The site forms part of a corridor of green spaces from Deptford High Street to Deptford Creek which are described in more detail in Vol 23 Table 11.4.1 below. The remainder of the assessment area is characterised by a series of communal green spaces and private gardens.

Vol 23 Table 11.4.1 Townscape – open space type and distribution

Open space	Distance from site	Character summary
Crossfield Amenity Space	Within the site	Small open space characterised by amenity grassland with scattered mature trees, divided by a wall marking the historic boundary between the former rectory and an area of former housing. The area to the east of the wall is enclosed by a fence and used as a dog exercise area. The area to the west of the wall is surrounded by a knee high rail. The open space is surrounded on all sides by roads. The site has been identified as being of average quality in the Lewisham Open Space Study[6]. Designated Public Open Space in the LB of Lewisham's UDP. Categorised as a small open space under the GLA public open space hierarchy[7].
St Paul's Churchyard	20m north	Green open space surrounding the Grade I listed St Paul's Church, enclosed by a brick wall and a dense band of mature trees, most of which are limes. The site has been identified as being of very good quality in the Lewisham Open Space Study[8]. Designated Public Open Space in the LB of Lewisham's UDP. Categorised as a small open space under the GLA public open space hierarchy.
Sue Godfrey Nature Reserve	30m east	Linear nature reserve characterised by open grassland, low growing shrubs and scattered mature trees, contained by a low brick wall. The site has been identified as being of good quality in the Lewisham Open Space Study[9]. Designated Public Open Space in the LB of Lewisham's UDP. Categorised as a local park under the GLA public open space hierarchy
Ferranti Park	150m east	Small park on the edge of the Sue Godfrey Nature Reserve, characterised by open grassland with scattered trees and shrubs along the boundaries. The park includes play facilities and seating. The site has been identified as being of excellent quality in the Lewisham Open Space Study[10]. Categorised as a small open space under

Open space	Distance from site	Character summary
		the GLA public open space hierarchy.
Laban Centre Open Space	200m east	Small green space in front of the Laban Dance Centre, characterised by grassed angular landforms and terraces. Categorised as a small open space under the GLA public open space hierarchy.

Transport routes

11.4.12 Vol 23 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.

11.4.13 The site is located immediately adjacent to Deptford Church Street, which is characterised by relatively high levels of traffic, and the mainline railway between Deptford and Greenwich Stations. The railway is elevated on a viaduct. The other strategic route in the area is Evelyn Street/Creek Road to the north of the site. Deptford High Street, to the west of the site, is also characterised by relatively heavy flows of traffic. Deptford mainline Station is located approximately 200m to the west of the site.

Site character assessment

11.4.14 The site is located in a triangle of green space adjacent to the Grade I listed St Paul's Church and surrounded by Coffey Street to the north, Deptford Church Street to the east and Crossfield Street to the south and west. The site is located within St Paul's Conservation Area, designated by the LB of Lewisham. The site is also located within the London View Management Framework (LVMF) London Panorama 6A.1 (Blackheath Point to St Paul's Cathedral).

11.4.15 The character of the site is illustrated by Vol 23 Plate 11.4.1 and the components of the site are described in more detail in Vol 23 Table 11.4.2.

Vol 23 Plate 11.4.1 The character of the site

Date taken: 10 August 2011. 18mm lens.

Vol 23 Table 11.4.2 Townscape – site components

ID	Component	Description	Condition
01	Brick wall	Brick built wall across the centre of the site, forming the historic boundary between the rectory and an area of housing. Parts of the wall are crumbling and graffiti and other damage is also evident in some locations.	Poor condition
02	Mature trees	Scattered mature trees across the triangle of open space.	Good condition
03	Boundary fencing	Steel railings surrounding the eastern part of the site with gated access.	Poor condition
04	Knee high rail	Low railing surrounding the majority of the site, west of the brick wall that divides the open space.	Fair condition
05	Amenity grassland	Area of flat, regularly mown amenity grassland across the footprint of the site	Fair condition

11.4.16 A baseline description of St Paul's Conservation Area as a heritage asset is provided in Section 7.4 of this volume.

11.4.17 The condition of the townscape within the site is fair, with some components in need of repair.

11.4.18 Despite the use of the site as a green amenity space (located within a sequence of green spaces) its tranquillity is reduced by the surrounding roads, adjacent on-street parking and elevated railway line with industrial units in the arches. Therefore the site has a moderate level of tranquillity.

11.4.19 The townscape of the character area is valued at the borough level, by virtue of the conservation area designation.

11.4.20 Although the site has a moderate level of tranquillity and a fair condition, the borough value of the site means it has a high sensitivity to change.

Townscape character assessment

11.4.21 The townscape character areas surrounding the site are identified in Vol 23 Figure 11.4.5. They are ordered from the north of the site and continue around the site in a clockwise direction. Each area is described below.

St Paul's Conservation Area TCA

11.4.22 This character area is defined by the St Paul's Conservation Area boundary, designated by the LB of Lewisham. The area is dominated by the Grade I listed St Paul's Church, which is set amongst a medium sized area of interlinked open green space. The church itself is surrounded by a walled churchyard with mature trees around the boundary, the majority of which are limes. The north of the area is characterised by two to three storey residential terraces aligned on a grid pattern, parallel with the church and its grounds. The southern boundary of the area is formed by the elevated mainline railway, adjacent to St Joseph's Roman RC primary school and a series of commercial premises within the railway arches. The character of this area is illustrated by Vol 23 Plate 11.4.2.

Vol 23 Plate 11.4.2 St Paul's Conservation Area TCA

Date taken: 1 September 2011. 18mm lens.

11.4.23 A baseline description of St Paul's Conservation Area, the Grade I listed St Paul's Church and St Joseph's Roman Catholic School as heritage assets is provided in Section 7.4 of this volume.

11.4.24 The buildings and public realm within the area are well maintained, with the exception of some components around the boundary of the church, including parts of the wall and roadways. However, the overall townscape condition is considered to be good.

11.4.25 Despite the presence of the railway along the southern boundary of this area, the townscape has moderate levels of tranquillity due to its residential character and density of open spaces and mature trees.

11.4.26 The townscape of the character area is valued at the borough level, by virtue of the conservation area designation.

11.4.27 Due to its good condition and borough value attributed to the townscape, this character area has a high sensitivity to change.

Creek Road Residential TCA

11.4.28 This area is comprised of recent residential developments either side of Creek Road. The area is characterised by a mix of medium sized residential apartment blocks from three to four storeys, some two storey semi-detached residences and seven storey residential blocks to the north of Creek Road. The buildings are set amongst some communal grassed areas, larger areas of car parking and some small private gardens. The area is enclosed in character. The character of this area is illustrated by Vol 23 Plate 11.4.3.

Vol 23 Plate 11.4.3 Creek Road Residential TCA

Date taken: 1 September 2011. 18mm lens.

11.4.29 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.30 Despite the presence of Creek Road through the centre of the area, the townscape has moderate levels of tranquillity due to its residential character and the enclosed nature of the area.

11.4.31 The townscape of the character area is likely to be locally valued by residents within the area.

11.4.32 Due to the local value attributed to the townscape, the enclosed nature of the built environment and moderate levels of tranquillity, this character area has a medium sensitivity to change.

Laban Centre and Bronze Street Open Space TCA

11.4.33 This character area comprises a series of interconnected green open spaces between Deptford Church Street and the Laban Dance Centre. The area includes:

a. Sue Godfrey Nature Reserve

b. Ferranti Park

c. Laban Centre open space and Dance Centre.

11.4.34 Part of this area is located within Deptford Creekside Conservation Area. The character of this area is illustrated by Vol 23 Plate 11.4.4. A baseline description of Deptford Creekside Conservation Area as a heritage asset is provided in Section 7.4 of this volume.

Vol 23 Plate 11.4.4 Laban Centre and Bronze Street Open Space TCA

Date taken: 1 September 2011. 18mm lens.

11.4.35 This area is characterised by the planting and amenity provided by the open spaces, which are largely enclosed in nature due to the presence of boundary walls and associated mature vegetation and trees.

11.4.36 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.37 The area has a high level of tranquillity due to its location surrounded by quiet residential street combined with the character and enclosed nature of the open spaces.

11.4.38 Due to the conservation area designation, the townscape of this character area is valued at the borough scale and the townscape of the character area is likely to be locally valued by residents within the area.

11.4.39 Due to the enclosed nature of the open spaces and local value of the townscape, despite the borough value of the townscape, the area has a medium sensitivity to change.

Creekside Residential TCA

11.4.40 This area comprises a residential area located between Deptford Church Street to the west and Creekside to the east. The area is characterised by large five storey residential apartment blocks set within communal amenity grassland with a high density of mature scattered trees. The area is bisected by the mainline railway, which runs east-west through the area on a viaduct, with some of the bridge arches open to allow pedestrian access. The area is enclosed in character. This character area is located within Deptford Creekside Conservation Area. The character of this area is illustrated by Vol 23 Plate 11.4.5. A baseline description of Deptford Creekside Conservation Area as a heritage asset is provided in Section 7.4 of this volume.

Vol 23 Plate 11.4.5 Creekside Residential TCA

Date taken: 1 September 2011. 18mm lens.

11.4.41 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.42 Despite the presence of Deptford Church Street to the west, and industrial uses to the east of this area, the townscape has moderate levels of tranquillity due to its residential character, the density of mature trees and the enclosed nature of the area.

11.4.43 Due to the conservation area designation, the townscape of this character area is valued at the borough scale and the townscape of the character area is likely to be locally valued by residents within the area.

11.4.44 Due to the inward looking nature of the built environment and moderate levels of tranquillity, despite the borough value of the townscape, this character area has a medium sensitivity to change.

Deptford Residential TCA

11.4.45 This area comprises a largely residential area located to the east and west of Deptford High Street and bounded by Deptford Church Street in the east and the mainline railway (on viaduct) in the north. The area is characterised by large residential apartment blocks up to approximately five storeys high, set amongst smaller scale residential terraces up to three storeys high. The area also includes a series of public, private and communal green spaces. Other uses within the character area include schools and some small retail units. In the south of the character area, the buildings are smaller in scale. The area is inward looking in character. The character of this area is illustrated by Vol 23 Plate 11.4.6.

Vol 23 Plate 11.4.6 Deptford Residential TCA

Date taken: 1 September 2011. 18mm lens.

11.4.46 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.47 Despite the presence of Deptford Church Street to the east and Deptford High Street cutting through the centre of this area, the townscape has moderate levels of tranquillity due to its residential character and the enclosed nature of the area.

11.4.48 The townscape of the character area is likely to be locally valued by residents within the area.

11.4.49 Due to the local value attributed to the townscape, enclosed nature of the built environment and moderate levels of tranquillity, this character area has a medium sensitivity to change.

Visual baseline

11.4.50 Vol 23 Figure 11.4.6 (see separate volume of figures) indicates the location of viewpoints referenced below. All 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 6A.1 – Blackheath Point to St Paul's Cathedral

11.4.51 This London Panorama designated in the LVMF passes through the centre of the site and has a high sensitivity to change.

Vol 23 Plate 11.4.7 London Panorama 6A.1: winter view

Date taken: 14 February 2012. 50mm lens.

11.4.52 The view (illustrated in Vol 23 Plate 11.4.7) towards St Paul's Cathedral in the City of London is largely unobstructed, but framed by tall buildings, the most visually apparent being St Paul's Church in Deptford (Grade I listed). The site is partially visible in the middle ground of the view, set in front of the elevated DLR and railway.

Residential

11.4.53 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 southwest from residences on Berthon Street at the junction with Deptford Church Street

11.4.54 This viewpoint is representative of the typical view from residential properties on Berthon Street, at the junction with Deptford Church Street.

Vol 23 Plate 11.4.8 Viewpoint 1.1: winter view

Date taken: 20 December 2011. 18mm lens.

11.4.55 The foreground of the view (illustrated in Vol 23 Plate 11.4.8) is dominated by Deptford Church Street, characterised by high levels of traffic. The site is visible in the middle ground of the view, with the existing wall running through the open space visible in the right hand side of the image. The mature trees within the site form a key component of the view. The railway viaduct and buildings to the south of it form the background of the view. Views of the site are largely unobstructed from this location.

Vol 23 Plate 11.4.9 Viewpoint 1.1: summer view

Date taken: 10 August 2011. 18mm lens.

11.4.56 In summer, deciduous trees within the site and the open space to the north, outside St Paul's Church form a more dominant component of the view (illustrated in Vol 23 Plate 11.4.9), partially screening views of the site.

Viewpoint 1.2: View south from residences on Creek Road at the junction with McMillan Street

11.4.57 This viewpoint is representative of the typical view from residential properties located on the corner of Creek Road and McMillan Street.

Vol 23 Plate 11.4.10 Viewpoint 1.2: winter view

Date taken: 14 February 2012. 35mm lens.

11.4.58 The linear view towards the site (illustrated in Vol 23 Plate 11.4.10) is framed by residential buildings in the foreground and mature trees along Deptford Church Street in the middle ground. The elevated railway line forms the background of the view. The mature trees within the eastern part of the site are visible in the background of the view. The western part of the site is largely obscured by intervening buildings and trees.

Viewpoint 1.3: View west from the rear of residences fronting onto Bronze Street

11.4.59 This viewpoint is representative of the oblique view from the rear of residential properties fronting onto Bronze Street.

Vol 23 Plate 11.4.11 Viewpoint 1.3: winter view

Date taken: 20 December 2011. 35mm lens.

11.4.60 The foreground of the view (illustrated in Vol 23 Plate 11.4.11) is dominated by mature tree planting in the communal green space adjacent to the residential block. The site forms the middle ground of the view, located on the opposite side of Deptford Church Street. Views of the site are largely unobstructed from this location.

Vol 23 Plate 11.4.12 Viewpoint 1.3: summer view

Date taken: 10 August 2011. 35mm lens.

11.4.61 In summer, the view of the site (illustrated in Vol 23 Plate 11.4.12) is largely screened by deciduous trees in the foreground and background of the view.

Viewpoint 1.4: View northwest from residences on Deptford Church Street, south of the railway line

11.4.62 This viewpoint is representative of the view from residential properties along Deptford Church Street, immediately to the south of the elevated mainline railway.

Vol 23 Plate 11.4.13 Viewpoint 1.4: winter view

Date taken: 20 December 2011. 18mm lens.

11.4.63 The foreground of the view (illustrated in Vol 23 Plate 11.4.13) is dominated by the elevated railway and traffic along Deptford Church Street. The site is visible through the railway bridge, forming the background of the view, characterised by the mature trees within the open space.

Vol 23 Plate 11.4.14 Viewpoint 1.4: summer view

Date taken: 10 August 2011. 18mm lens.

11.4.64 In summer, the mature trees along the edge of Deptford Church Street largely screen views towards the site (illustrated in Vol 23 Plate 11.4.14).

Viewpoint 1.5: View southeast from residences on Deptford High Street, close to Diamond Way

11.4.65 This viewpoint is representative of the typical view from the rear of residential properties along Deptford High Street, immediately to the south of Diamond Way, leading to Crossfield Street.

Vol 23 Plate 11.4.15 Viewpoint 1.5: winter view

Date taken: 20 December 2011. 18mm lens.

11.4.66 The view (illustrated in Vol 23 Plate 11.4.15) is an open panorama encompassing (from left to right) St Paul's Church and the churchyard, the site and the grounds of St Joseph's Roman RC Primary School. Views towards the site are unobstructed from this location.

Vol 23 Plate 11.4.16 Viewpoint 1.5: summer view

Date taken: 10 August 2011. 18mm lens.

11.4.67 In summer, the view towards the site (illustrated in Vol 23 Plate 11.4.16) is partially screened by intervening deciduous trees.

Recreational

11.4.68 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 southeast from the steps of St Paul's Church

11.4.69 This viewpoint is representative of the view for visitors to St Paul's Church, from the steps at the eastern entrance.

Vol 23 Plate 11.4.17 Viewpoint 2.1: winter view

Date taken: 20 December 2011. 18mm lens.

11.4.70 The foreground of the view (illustrated in Vol 23 Plate 11.4.17) is dominated by the character of the churchyard, including the historic brick boundary wall and a number of mature trees. Because of the elevated position of the viewpoint, mature trees within the site are visible beyond the boundary of the churchyard.

Vol 23 Plate 11.4.18 Viewpoint 2.1: summer view

Date taken: 23 May 2012. 18mm lens.

11.4.71 In summer, views towards the site (illustrated in Vol 23 Plate 11.4.18) are heavily screened by mature trees along the boundary of St Paul's Church.

11.4.72 A baseline description of the Grade I listed St Paul's Church as a heritage asset is provided in Section 7.4 of this volume.

Viewpoint 2.2: View southwest from Ferranti Park

11.4.73 This viewpoint is representative of the view for recreational users of Ferranti Park, from the seating area towards the centre of the open space.

Vol 23 Plate 11.4.19 Viewpoint 2.2: winter view

Date taken: 20 December 2011. 18mm lens.

11.4.74 The foreground of the view (illustrated in Vol 23 Plate 11.4.19) is dominated by mature planting within both this park and the adjacent Sue Godfrey Nature Reserve. The mature trees within the site are intermittently visible in the background of the view (in the centre of the image) as part of the sequence of green spaces connecting Deptford High Street and Deptford Creek.

Construction base case

11.4.75 For the purposes of the construction phase assessment, it is assumed that there would be no substantial change in the townscape and visual baseline between 2012 and Site Year 2 of construction.

Operational base case

11.4.76 The base case in Year 1 of operation taking into account the mixed use development described in para. 11.3.22 would affect the character of Deptford Residential TCA to a limited extent. However, the overall character, described in para. 11.4.45 to para. 11.4.49 would not be substantially altered, and the sensitivity of the character area would remain medium.

11.4.77 All other receptors would remain as detailed in the baseline.

11.5 Construction effects assessment

11.5.1 The following section details the likely significant effects arising from construction at Deptford Church Street.

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[11] 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 works 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 phase plans).

Site character assessment

11.5.4 Effects on the character of the site would arise from felling of trees, removal of the brick wall through the centre of the site and construction activity associated with the construction of the CSO shaft and ventilation structures, and secondary lining of the tunnel. The impacts on specific components of the site are described in Vol 23 Table 11.5.1.

Vol 23 Table 11.5.1 Townscape – impacts on existing site components during construction

ID	Component	Impacts
01	Brick wall	This would be removed during construction.
02	Mature trees	Approximately 45 trees would be removed during construction.
03	Boundary fencing	This would be removed during construction.
04	Knee high rail	This would be removed during construction.
05	Amenity grassland	This would be removed during construction, to be replaced by hardstanding to facilitate heavy construction activities.

11.5.5 The moderate levels of tranquillity within the site would be substantially altered due to introduction of construction vehicles, plant equipment and high levels of activity in an area of open green space.

11.5.6 Due to the changes in character and tranquillity caused by clearance of the site and intense construction activity, the magnitude of change is considered to be high.

11.5.7 The high magnitude of change, assessed alongside the high sensitivity of the site, would result in **major adverse** effects.

11.5.8 The assessment of specific effects on the setting of St Paul's Conservation Area as a heritage asset is set out in Section 7 of this volume. The historic environment assessment identifies a moderate

adverse effect on the setting of this asset as the conservation area is larger than the area defined as the site, and therefore parts of the setting are largely unaffected.

Townscape character areas assessment

St Paul's Conservation Area TCA

11.5.9 The proposed site is set adjacent to this character area. The setting of part of this area would be affected by the clearance of mature trees at the site, and the intensity of construction activity, including the presence of site hoardings, welfare facilities and construction plant. The setting of St Paul's Church, as the main component of the areas character, would be particularly affected, given its close proximity to the site.

11.5.10 The area has a moderate level of tranquillity, which would be affected by the presence of construction activity at the site, including construction plant, and road transport along the streets surrounding the site.

11.5.11 Due to the changes to part of the areas setting, particularly of St Paul's Church, and effects on tranquillity, the magnitude of change is considered to be medium.

11.5.12 The medium magnitude of change, assessed alongside the high sensitivity of this character area, would result in **moderate adverse** effects.

11.5.13 The assessment of specific effects on the setting of St Paul's Conservation Area, the Grade I listed St Paul's Church and St Joseph's Roman Catholic School as heritage assets is set out in Section 7 of this volume. The historic environment assessment identifies a minor adverse effect on the setting of St Joseph's Roman Catholic School as the site makes little contribution to the significance of the asset.

Creek Road Residential TCA; and Laban Centre and Bronze Street Open Space TCA

11.5.14 The proposed site forms part of the wider setting for these character areas. The setting of the areas would be affected by the clearance of mature trees at the site, and the intensity of construction activity, including the presence of site hoardings, welfare facilities and construction plant. However, the setting of the majority of these character areas would be largely unaffected, particularly given their inward looking character.

11.5.15 The areas have a moderate and high level of tranquillity respectively, which would be affected to a limited extent by the wider presence of construction activity at the site and road transport along the streets surrounding the site.

11.5.16 Due to changes to part of the setting of the areas and limited changes to tranquillity, the magnitude of change is considered to be low.

11.5.17 The low magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **minor adverse** effects.

11.5.18 The assessment of specific effects on the setting of Deptford Creekside Conservation Area as a heritage asset is set out in Section 7 of this volume.

Creekside Residential TCA; and Deptford Residential TCA

11.5.19 The proposed site forms part of the wider setting for these character areas. The setting of the areas would be affected to a limited extent by the clearance of mature trees at the site, and the intensity of construction activity, including the presence of site hoardings, welfare facilities and construction plant. However, the setting of the majority of these character areas would be largely unaffected because of the presence of the elevated railway line partially obscuring the site.

11.5.20 The areas have a moderate level of tranquillity, which would be affected to a limited extent by the wider presence of construction activity at the site and road transport along the streets surrounding the site.

11.5.21 Due to changes in the wider setting and limited changes to tranquillity, the magnitude of change is considered to be low.

11.5.22 The low magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **minor adverse** effects.

11.5.23 The assessment of specific effects on the setting of Deptford Creekside Conservation Area as a heritage asset is set out in Section 7 of this volume.

Townscape – sensitivity test for programme delay

11.5.24 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 11.5.22). While it is assumed that the Giffin Street Regeneration Area development would be complete and operational, this would not change the sensitivity to change of the townscape character areas already presented (paras. 11.4.2 to 11.4.49).

Visual assessment

11.5.25 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 a view, would be in leaf.

London View Management Framework London Panoramas

London Panorama 6A.1 – Blackheath Point to St Paul's Cathedral

11.5.26 During construction, cranes at the site would be visible in the middle ground of the view, set in front of St Paul's Church in Deptford, but are unlikely to obstruct views of St Paul's Cathedral. Other construction activity at the site would be largely obscured by the intervening low-rise buildings. Therefore, the magnitude of change on this London Panorama is considered to be low.

11.5.27 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor adverse** effects.

Residential

Viewpoint 1.1: View southwest from residences on Berthon Street at the junction with Deptford Church Street; and Viewpoint 1.5: View southeast from residences on Deptford High Street, close to Diamond Way

11.5.28 The foreground of views from these locations would be affected by the removal of mature trees within the site, and the introduction of site hoardings, welfare facilities construction activity and plant, and intermittent road transport. The overall character of the views across the sequence of open spaces would be substantially altered, also affecting views of St Paul's Church. Therefore, the magnitude of change is considered to be high. The view of the proposed development from this viewpoint is illustrated in Vol 23 Plate 11.5.1 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 23 Figure 11.5.1 (see separate volume of figures). The verifiable photomontage shows an illustration of how the construction site may be set up during phase 1 (site setup and shaft construction). The layout of the construction activities may change within the maximum extent of working area (see Construction phases – phase 1 site setup and shaft construction [see separate volume of figures]).

Vol 23 Plate 11.5.1 Viewpoint 1.1 – illustrative construction phase photomontage

Date taken: 7 December 2011. 50mm lens.

11.5.29 The high magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **major adverse** effects.

Viewpoint 1.2: View south from residences on Creek Road at the junction with McMillan Street

11.5.30 The view down Deptford Church Street would be affected by intermittent visibility of road transport, set against the existing high levels of traffic. The background of the view would be affected to a limited extent by the removal of mature trees at the site, and the introduction of site hoardings, welfare facilities, construction activity and plant. However, this would be partially obscured by intervening mature trees, and the foreground of the view would remain largely unaffected. Therefore, the magnitude of change is considered to be low.

11.5.31 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor adverse** effects.

Viewpoint 1.3: View west from the rear of residences fronting onto Bronze Street

11.5.32 Oblique views from residences would be affected during construction. The middle ground of the view would be affected by the removal of mature trees and the existing brick wall within the site, and the introduction of site hoardings, welfare facilities construction activity and plant. However, the foreground of the view would be unchanged, and the presence of mature trees outside the residences would filter views of the site. Therefore, the magnitude of change is considered to be medium.

11.5.33 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Viewpoint 1.4: View northwest from residences on Deptford Church Street, south of the railway line.

11.5.34 Views from residences would be affected during construction. The view from residences towards the site, particularly from upper storeys, would be affected by the removal of mature trees at the site, and the introduction of site hoardings, welfare facilities, construction activity and plant. The railway bridge in the foreground of the view would partially obscure views of parts of the site. Therefore, the magnitude of change is considered to be medium.

11.5.35 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Recreational

Viewpoint 2.1: View southeast from the steps of St Paul's Church

11.5.36 The view beyond the walls of St Paul's Churchyard would be affected by the removal of mature trees within the site, and the introduction of site hoardings, welfare facilities, construction activity and plant. The overall character of the view, which at present is open and green in aspect, would be substantially altered. Therefore, the magnitude of change is considered to be high. The view of the proposed development from this viewpoint is illustrated in Vol 23 Plate 11.5.2 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 23 Figure 11.5.2 (see separate volume of figures). The verifiable photomontage shows an illustration of how the construction site may be set up during phase 1 (site setup and shaft construction). The layout of the construction activities may change within the maximum extent of working area (see Construction phases – phase 1 site setup and shaft construction [see separate volume of figures]).

Vol 23 Plate 11.5.2 Viewpoint 2.1 – illustrative construction phase photomontage

Date taken: 7 December 2011. 50mm lens.

11.5.37 The high magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **major adverse** effects.

11.5.38 The assessment of specific effects on the setting of the Grade I listed St Paul's Church as a heritage asset is set out in Section 7 of this volume. The historic environment assessment identifies a moderate adverse effect on the setting of this asset as the setting is wider than the field of view experienced by a pedestrian standing at this location looking towards the site. Therefore, much of the setting of the church would be unchanged, as opposed to the substantial change visible from this specific viewpoint.

Viewpoint 2.2: View southwest from Ferranti Park

11.5.39 Views from this location would be affected to a limited extent during construction. The background of the view towards the site would be affected by the removal of trees at the site and the presence of tall construction plant and cranes, partially screened by trees near the viewpoint. The foreground of the view would remain unaffected. Therefore, the magnitude of change is considered to be low.

11.5.40 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor adverse** effects.

Visual effects – sensitivity test for programme delay

11.5.41 For the assessment of visual 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. 11.5.23 to 11.5.38). While it is assumed that the Giffin Street Regeneration Area development would be complete and operational, this would not introduce additional visual receptors not already considered.

11.6 Operational effects assessment

11.6.1 The following section describes the likely significant effects arising during the operational phase at Deptford Church Street.

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 For the site, all surrounding townscape character areas and all viewpoints, it is considered that the commitment to a high quality design as detailed in the design principles summarised in para. 11.2.6 would lead to an improvement of the existing site. Where specific measures are of particular relevance to the effect on a receptor, these are described under each townscape character area and viewpoint below.

11.6.4 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

11.6.5 The proposed development would constitute a permanent enhancement of the character of the site. The permanent works layout would result in the creation of a new area of well designed publicly accessible open space, including areas of hard surfacing, grassed areas and new planting. The trees removed during construction would be replaced with at least the same number of native species, in line with an overall coherent landscape design for the open space. The works would also result in the removal of components of the site that are currently detrimental to its character and potential value as an amenity space, such as boundary fencing and the brick wall through the centre of the space.

11.6.6 A cluster of 6-8m high well designed ventilation columns would be located in the southern extent of the open space, and the 2.8-3m high electrical and control kiosk and narrow 6m high ventilation column serving the interception chamber would be located along the eastern edge of the site, along Deptford Church Street. The design intent for the ventilation columns (which would be the project signature design) is illustrated on the Ventilation columns design intent figure – type C (see separate volume of figures – Section 1).

11.6.7 The impacts on specific components of the site are described in Vol 23 Table 11.6.1.

Vol 23 Table 11.6.1 Townscape – impacts on baseline components in Year 1 of operation

ID	Component	Impacts
01	Brick wall	This would be removed, with the location of the wall demarcated as part of the new design
02	Mature trees	Trees lost during construction would be replaced in line with a new landscape design for the site.
03	Boundary	The existing fencing, removed during construction,

ID	Component	Impacts
	fencing	would not be reinstated. New boundary fencing may be provided in line with a new landscape design for the site if considered necessary.
04	Knee high rail	The existing fencing, removed during construction, would not be reinstated. New boundary fencing may be provided in line with a new landscape design for the site if considered necessary.
05	Amenity grassland	Areas of this would be left as hard surfacing, while other areas would be reinstated as grass, in line with a new landscape design for the site.

11.6.8 The magnitude of change to the site is considered to be low due to the reinstatement of the majority of the open green character of the existing site, alongside removal of some elements currently detrimental to the site's character.

11.6.9 Due to the commitment to a high quality design for the public realm and above ground structures, the low magnitude of change, assessed alongside the high sensitivity of this character area, would result in **minor beneficial** effects.

11.6.10 The assessment of specific effects on the setting of St Paul's Conservation Area as a heritage asset is set out in Section 7 of this volume. The historic environment assessment identifies a moderate beneficial effect on the setting of this asset due to the opening up of views between and of the most significant heritage assets in the conservation area.

Townscape character areas assessment

11.6.11 This section describes effects arising from the proposed development in operation on townscape character areas surrounding the site. No assessment of townscape effects has been made for the following character areas, as the components of the operational scheme would not alter their setting:

a. Creek Road Residential TCA

b. Laban Centre and Bronze Street Open Space TCA

c. Creekside Residential TCA

d. Deptford Residential TCA.

St Paul's Conservation Area TCA

11.6.12 The proposed development would result in changes to the local setting of this character area, in particular the setting of St Paul's Church. The setting would be affected by the creation of areas of new paving, high quality above ground structures and new planting in the site, incorporated into a new landscape design for the space. The proposed development would comprise an improvement to the immediate setting of the area and also create greater accessibility to the adjacent open space and hence

appreciation of the Grade I listed church. However, the overall character of the setting, comprising a green open space with mature trees, would not be substantially altered. Therefore, the magnitude of change is considered to be low.

11.6.13 Due to the commitment to a high quality design for the public realm and above ground structures, the low magnitude of change, assessed alongside the high sensitivity of this character area, would result in **minor beneficial** effects.

11.6.14 The assessment of specific effects on the setting of St Paul's Conservation Area, the Grade I listed St Paul's Church and St Joseph's Roman Catholic School as heritage assets is set out in Section 7 of this volume. The historic environment assessment identifies a moderate beneficial effect on the setting of the conservation area and church due to the opening up of views between and of the most significant heritage assets in the conservation area.

Townscape – sensitivity test for programme delay

11.6.15 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. 11.6.5 to 11.6.14). 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 11.4.49).

Visual assessment

11.6.16 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.

11.6.17 No assessment of visual effects has been made for the following viewpoints, as the components of the operational scheme would either be obscured or would be barely perceptible in the background of the view:

a. London Panorama 6A.1 – Blackheath Point to St Paul's Cathedral

b. Viewpoint 1.2: View south from residences on Creek Road at the junction with McMillan Street

c. Viewpoint 2.2: View southwest from Ferranti Park.

Residential

Viewpoint 1.1: View southwest from residences on Berthon Street at the junction with Deptford Church Street; and Viewpoint 1.5: View southeast from residences on Deptford High Street close to Diamond Way

11.6.18 The above ground structures and newly planted trees would be highly visible in the foreground of the view from these locations, representing an improvement to the views in line with a new landscape design for the site. The views would also be improved through the removal of existing elements detrimental to the character of the site, including fencing around the edge of the site. However, the overall character of the views would be largely unchanged, due to the reinstatement of planting at the site.

Therefore, the magnitude of change is considered to be low. The view of the proposed development from this viewpoint is illustrated in Vol 23 Plate 11.6.1 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 23 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 23 Plate 11.6.1 Viewpoint 1.1 – illustrative operational phase photomontage

Date taken: 7 December 2011. 50mm lens.

11.6.19 The low magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **minor beneficial** effects during winter.

11.6.20 During summer, views towards the site would be partially obscured by mature trees in the foreground of the view. However, the magnitude of change is still considered to be low, which would give rise to **minor beneficial** effects during summer.

Viewpoint 1.3: View west from the rear of residences fronting onto Bronze Street

11.6.21 The above ground structures and newly planted trees would be intermittently visible in the background of the view from this location, representing a slight improvement to the view in line with a new land**scape design for** the site. The view would also be improved through the removal of existing elements detrimental to the character of the site, including fencing along the eastern edge of the site. However, the overall character of the view would be largely unchanged, due to the reinstatement of planting at the site and the presence of mature planting in the foreground of the view. Therefore, the magnitude of change is considered to be low.

11.6.22 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects during winter.

11.6.23 During summer, views towards the site would be largely obscured by mature trees in the foreground of the view. Therefore, the magnitude of change is considered to be negligible, which would give rise to a **negligible** effect during summer.

Viewpoint 1.4: View northwest from residences on Deptford Church Street, south of the railway line

11.6.24 The above ground structures and newly planted trees would be partially visible in the background of the view from this location, beyond the railway bridge, representing a slight improvement to the view in line with a new landscape design for the site. The view would also be improved through

the removal of existing elements detrimental to the character of the site, including fencing along the eastern edge of the site. However, the overall character of the view would be largely unchanged, due to the reinstatement of planting at the site and the presence of mature planting in the foreground of the view. Therefore, the magnitude of change is considered to be low.

11.6.25 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects during winter.

11.6.26 There would be no change to the assessment during summer.

Recreational

Viewpoint 2.1: View southeast from the steps of St Paul's Church

11.6.27 The new area of public realm, above ground structures and newly planted trees would be highly visible from this location, representing an improvement to the view in line with a new landscape design for the site. The view would also be improved through the removal of existing elements detrimental to the character of the site, including fencing around the edge of the site. However, the overall character of the view would be largely unchanged, due to the reinstatement of planting at the site. Therefore, the magnitude of change is considered to be low. The view of the proposed development from this viewpoint is illustrated in Vol 23 Plate 11.6.2 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 23 Figure 11.6.2 (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 23 Plate 11.6.2 Viewpoint 2.1 – illustrative operational phase photomontage

Date taken: 7 December 2011. 50mm lens.

11.6.28 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects during winter.

11.6.29 During summer, views towards the site would be partially obscured by mature trees in the foreground of the view along the boundary of St Paul's Church. However, the magnitude of change is still considered to be low, which would give rise to **minor beneficial** effects during summer.

11.6.30 The assessment of specific effects on the setting of the Grade I listed St Paul's Church as a heritage asset is set out in Section 7 of this volume. The historic environment assessment identifies a moderate beneficial

effect on the setting of this asset due to the creation of an improved open space that would enhance appreciation of the church.

Visual effects – sensitivity test for programme delay

11.6.31 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. 11.6.17 to 11.6.30). This is on the basis that there are no known schemes within the assessment area that would introduce new visual receptors, or alter visibility of the proposed development from the viewpoints described in paras. 11.4.51 to 11.4.74.

Operational effects Year 15

Townscape site assessment – Year 15

11.6.32 In Year 15 of operation, the tree and shrub planting established as part of the scheme would have matured, further improving the character of the site. In light of this the magnitude of change to the site is considered to be medium.

11.6.33 The medium magnitude of change, assessed alongside the high sensitivity of the site, would result in **moderate beneficial** effects.

Townscape character areas assessment – Year 15

St Paul's Conservation Area

11.6.34 The matured trees established as part of the scheme would further improve the setting of this character area by Year 15 of operation. Therefore, the magnitude of change is considered to be medium.

11.6.35 The medium magnitude of change, assessed alongside the high sensitivity of the character area, would result in **moderate beneficial** effects.

Visual assessment – Year 15

11.6.36 Visual effects during Year 15 of operation would remain the same as the assessment for Year 1 for the following viewpoints, as the matured trees would not substantially alter the character of the views:

a. Viewpoint 1.3: View west from the rear of residences fronting onto Bronze Street

b. Viewpoint 1.4: View northwest from residences on Deptford Church Street south of the railway line.

11.6.37 Effects on the following viewpoints would change due to the maturation of tree and shrub planting:

a. Viewpoint 1.1: View southwest from residences on Berthon Street at the junction with Deptford Church Street (residential)

b. Viewpoint 1.5: View southeast from residences on Deptford High Street close to Diamond Way (residential)

c. Viewpoint 2.1: View southeast from the steps of St Paul's Church (recreational).

11.6.38 In all cases, the matured trees and other vegetation established as part of the scheme would further improve the view from these locations. Therefore the magnitude of change is considered to be medium.

11.6.39 The medium magnitude of change, assessed alongside the high sensitivity of the receptors, would result in **moderate beneficial** effects.

11.6.40 This assessment 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 para. 11.3.15, construction of the mixed use development to the south of the site located between Giffin Street and Resolution Way (50m to the south of the site) would be ongoing during Year 1 of construction at the Deptford Church Street site.

11.7.2 Cumulatively, construction activity associated with both of these sites would elevate effects on Deptford Residential TCA (which would be subject to significant effects) and, to a limited extent, viewpoint 1.4 (where the already significant effects would be elevated to a limited extent).

11.7.3 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, the mixed use development between Giffin Street and Resolution Way would be assumed to be complete and operational. Therefore, there would be no cumulative effects.

Operational effects

11.7.4 As detailed in the site development schedule (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 and enhancement

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 23 Table 11.10.1 Townscape – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
The site	Change to character due to the clearance of trees and existing wall, and the intensity of construction activity.	Major adverse	No mitigation possible	Major adverse
St Paul's Conservation Area TCA	Substantial change to part of the areas setting due to the removal of trees and presence of site hoardings, welfare facilities, construction activity and plant.	Moderate adverse	No mitigation possible	Moderate adverse
Creek Road Residential TCA	Change to part of the wider setting due to the removal of trees and presence of site hoardings, welfare facilities, construction activity and plant.	Minor adverse	Not required	Minor adverse
Laban Centre and Bronze Street Open Space TCA	Change to part of the wider setting due to the removal of trees and presence of site hoardings, welfare facilities, construction activity and plant.	Minor adverse	Not required	Minor adverse
Creekside Residential TCA	Slight change to setting due to the removal of trees and presence of cranes, site hoardings, construction activity and road transport.	Minor adverse	Not required	Minor adverse
Deptford Residential TCA	Slight change to setting due to the removal of trees and presence of cranes, site hoardings, construction activity and road transport.	Minor adverse	Not required	Minor adverse

Vol 23 Table 11.10.2 Visual – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
London View Management Framework London Panoramas				
London Panorama 6A.1 – Blackheath Point to St Paul's Cathedral	Visibility of cranes, partially obscuring middle ground views of St Paul's Church Deptford.	Minor adverse	Not required	Minor adverse
Residential				
Viewpoint 1.1: View southwest from residences on Berthon Street at the junction with Deptford Church Street	Foreground visibility of loss of trees, site hoardings, welfare facilities, construction activity and plant, and intermittent road transport.	Major adverse	No mitigation possible	Major adverse
Viewpoint 1.2: View south from residences on Creek Road at the junction with McMillan Street	Intermittent visibility of road transport and background visibility of site hoardings and construction activity, and loss of trees.	Minor adverse	Not required	Minor adverse
Viewpoint 1.3: View west from the rear of residences fronting onto Bronze Street	Oblique visibility of site hoardings, welfare facilities, construction activity and plant, and the loss of trees.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 1.4: View northwest from residences on Deptford Church Street, south of the railway line	Partial visibility of site hoardings, welfare facilities, construction activity and plant, and the loss of trees.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 1.5: View southeast from residences on Deptford High Street, close to Diamond Way	Foreground visibility of site hoardings, construction activity, cranes, road transport and the loss of trees.	Major adverse	No mitigation possible	Major adverse
Recreational				
Viewpoint 2.1: View southeast from	Foreground visibility of site hoardings,	Major	No	Major adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
the steps of St Paul's Church	welfare facilities, construction activity and plant, and the loss of trees.	adverse	mitigation possible	
Viewpoint 2.2: View southwest from Ferranti Park	Background visibility of removed trees, tall construction plant and cranes.	Minor adverse	Not required	Minor adverse

Vol 23 Table 11.10.3 Townscape – summary of Year 1 operational assessment

Receptor[i]	Effect	Significance of effect	Mitigation	Significance of residual effect
The site	Change in character through the creation of a new area of well design publicly accessible open space, including areas of hard surfacing, grassed areas and new planting, and removal of components detrimental to the character, in line with a new landscape design for the open space.	Minor beneficial	Not required	Minor beneficial
St Paul's Conservation Area TCA	Change to setting through the new public realm design, new planting and high quality above ground structures.	Minor beneficial	Not required	Minor beneficial

[i] Townscape character areas not assessed during operation (refer to para. 11.6.11) are not included in the summary table

Vol 23 Table 11.10.4 Visual – summary of Year 1 operational assessment

Receptor[ii]	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential				
Viewpoint 1.1: View southwest from residences on Berthon Street at the junction with Deptford Church Street	Visibility of the new public realm, tree planting and above ground structures, incorporated into a new landscape design for the site.	winter – Minor beneficial	winter – Not required	winter – Minor beneficial
		summer – Minor beneficial	summer – Not required	summer – Minor beneficial
Viewpoint 1.3: View west from the rear of residences fronting onto Bronze Street	Background visibility of the new tree planting and above ground structures, incorporated into a new landscape design for the site.	winter – Minor beneficial	winter – Not required	winter – Minor beneficial
		summer – Negligible	summer – Not required	summer – Negligible
Viewpoint 1.4: View northwest from residences on Deptford Church Street, south of the railway line	Partial visibility of the new tree planting and above ground structures, incorporated into a new landscape design for the site.	winter – Minor beneficial	winter – Not required	winter – Minor beneficial
		summer – Minor beneficial	summer – Not required	summer – Minor beneficial
Viewpoint 1.5: View southeast from residences on Deptford High Street, close to Diamond Way	Visibility of the new public realm, tree planting and above ground structures, incorporated into a new landscape design for the site.	winter – Minor beneficial	winter – Not required	winter – Minor beneficial
		summer – Minor beneficial	summer – Not required	summer – Minor beneficial
Recreational				

[ii] Viewpoints not assessed during operation (refer to para. 11.6.17) are not included in the summary table

Receptor[ii]	Effect	Significance of effect	Mitigation	Significance of residual effect
Viewpoint 2.1: View southeast form the steps of St Paul's Church	Visibility of the new public realm, tree planting and above ground structures, incorporated into a new landscape design for the site.	winter – Minor beneficial	winter – Not required	winter – Minor beneficial
		summer – Minor beneficial	summer – Not required	summer – Minor beneficial

Vol 23 Table 11.10.5 Townscape – summary of Year 15 operational assessment

Receptor[iii]	Effect	Significance of effect	Mitigation	Significance of residual effect
The site	Improved character through maturing of trees established as part of the scheme	Moderate beneficial	Not required	Moderate beneficial
St Paul's Conservation Area TCA	Improved setting through maturing of trees established as part of the scheme	Moderate beneficial	Not required	Moderate beneficial

[iii] Only townscape character areas where the assessment differs in Year 15 compared to Year 1 are included in the summary table

Vol 23 Table 11.10.6 Visual – summary of Year 15 operational assessment

Receptor[iv]	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential				
Viewpoint 1.1: View southwest from residences on Berthon Street at the junction with Deptford Church Street	Improved view due to maturing of trees established as part of the scheme	Moderate beneficial	Not required	Moderate beneficial
Viewpoint 1.5: View southeast from residences on Deptford High Street, close to Diamond Way	Improved view due to maturing of trees established as part of the scheme	Moderate beneficial	Not required	Moderate beneficial
Recreational				
Viewpoint 2.1: View southeast form the steps of St Paul's Church	Improved view due to maturing of trees established as part of the scheme	Moderate beneficial	Not required	Moderate beneficial

[iv] Only viewpoints where the assessment differs in Year 15 compared to Year 1 are included in the summary table

References

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

[2] LB of Lewisham. *LDF Core Strategy* (June 2011).

[3] Royal Borough of Greenwich. *LDF Core Strategy* (2006).

[4] London Borough of Lewisham. *Deptford Creekside Conservation Area Appraisal* (May 2012).

[5] Mayor of London. *Revised Supplementary Planning Guidance – London View Management Framework* (July 2010).

[6] LB of Lewisham. *Lewisham Open Space Study* (2010)

[7] Mayor of London. *The London Plan Spatial Development Strategy for Greater London* (July 2011)

[8] LB of Lewisham (2011). *See citation above.*

[9] LB of Lewisham (2011). *See citation above.*

[10] LB of Lewisham (2011). *See citation above.*

[11] Department of Environment, Food and Rural Affairs (2012). See citation above.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 12: Transport

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Thames Tideway Tunnel

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Thames Tideway Tunnel

Environmental Statement

Volume 23: Deptford Church Street 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 Deptford Church Street 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. Docklands Light Railway (DLR) and National Rail services

e. car parking

f. 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 nearby residents and commercial premises, St Paul's Church, St Joseph's Roman Catholic Primary School and users of recreational facilities in the area. There are no river services in the vicinity of the Deptford Church Street site and it is not proposed to use the river to transport materials at this site; therefore, effects on river passenger services and river navigation are not considered at this site.

12.1.4 The operation of the Deptford Church Street site has the potential to affect parking and 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 Vol 2 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 Deptford Church Street site. The *Transport Assessment* will accompany 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 23 Deptford Church Street 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 of this volume.

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 be located on the amenity area between Crossfield Street and Coffey Street. In order to provide working areas, the site would also occupy the western footway of Deptford Church Street (A2209). The northbound carriageway and footway of Deptford Church Street would need to be closed for periods of time during the works. Two-way traffic flows would be maintained throughout the construction period through the use of a contraflow on part of the southbound carriageway.

12.2.3 During construction it anticipated that the elements listed under para 12.1.2 above may be affected as a result of the additional construction traffic associated with the Deptford Church Street site and other Thames Tideway Tunnel project construction sites, the diversions to pedestrian routes (as a result of the footway closures), pedestrian crossing relocation, bus stop relocation and changes to car parking arrangements in the area.

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 23 Table 12.2.1.

Vol 23 Table 12.2.1 Transport – construction traffic 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)	64 movements per day (32 vehicle trips)
Typical types of lorry requiring access (comprising rigid-bodied, flatbed and articulated vehicles)	Excavation material lorries Ready mix concrete mixer lorries Steel reinforcement lorries Office delivery lorries Plant and equipment lorries Imported fill 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 materials 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). During a period of extended hours working there would be days when work would extend up to 22.00 for large concrete pours for diaphragm wall construction. Outside this period it would only be in exceptional circumstances that heavy goods vehicle (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 London Borough (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. This shows that the site would be accessed from Crossfield Street, with vehicles turning left from the northbound carriageway of Deptford Church Street (A2209). Vehicles would leave the site onto Coffey Street and would re-join Deptford Church Street (A2209) northbound.

12.2.8 The construction traffic would be directed towards the site from Deptford Bridge (A2) in the south.

12.2.9 Vehicles leaving the site would be directed north along Deptford Church Street (A2209) and then east along Creek Road (A200), south along Norman Road (B206) and Greenwich High Road (A206) back to the A2 which forms part of the TLRN. This vehicle routing would be applied during both phases of construction.

12.2.10 Vol 23 Figure 12.2.1 (see separate figures volume) shows the construction traffic routes for access to/from the Deptford Church Street site. Construction routes have been discussed with both Transport for London (TfL) and the Local Highway Authority (LHA), LB of Lewisham for the purposes of the assessment.

Construction workers

12.2.11 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 23 Table 12.2.2.

Vol 23 Table 12.2.2 Transport – maximum estimated 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.*

12.2.12 It is difficult to predict with certainty the directions from and to 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 trip origin-destination distributions as construction lorries.

12.2.13 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 in which the Deptford Church Street site is located.

12.2.14 The methodology for assigning worker trips to the transport networks is described in Vol 2 Section 12 Environmental assessment methodology.

12.2.15 At the Deptford Church Street 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*), 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 para. 12.5.3.

Code of Construction Practice

12.2.16 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.

12.2.17 In addition to the general measures within the *CoCP Part A*, the following measures have been incorporated into the *CoCP Part B* (Section 5) relating to the Deptford Church Street site:

a. site gate access would be from Deptford Church Street (A2209) and Crossfield Street. A right turn only is required from Crossfield Street. No other access route is permitted

b. site egress would be onto Coffey Street with only a right turn from the site and then left turn onto Deptford Church Street (A2209). No other access route is permitted

c. the connection works within Deptford Church Street (A2209) are to be planned to minimise the duration of the construction works. The bus lanes are to be suspended during this phase of works

[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. one lane in each direction is to be maintained at all times. The minimum width of traffic lanes to be retained is 3.25m

e. adequate notice is required for the suspension of bus lanes and relocation of the bus stops. Bus stop relocation to be confirmed with TfL and the LB of Lewisham

f. access/egress into Coffey Street to be maintained at all times unless otherwise agreed

g. on-street parking spaces along Coffey Street would be suspended and the unmarked kerbside parking capacity along Crossfield Street would be prohibited

h. relocation of the existing pedestrian crossing at corner of Deptford Church Street (A2209) and Coffey Street to be confirmed with TfL and the LB of Lewisham

i. the footway diversion along Deptford Church Street site is to be adequately signed

j. the contractor is to liaise with St Paul's Church to coordinate traffic movements to and from the site, including:
(i) limit vehicle movements during funeral arrivals and departures
(ii) facilitate horse delivery lorries for horse-drawn hearses
(iii) complete Saturday works and traffic movements before 13:00.

12.2.18 The effective implementation of the *CoCP Part A* and *Part B* measures is assumed within the assessment.

12.2.19 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]; this will accompany the application. The *Draft Project Framework Travel Plan* addresses project-wide travel planning measures, including the need for a project-wide Travel Plan 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 measures of relevance to the *Draft Project Framework Travel Plan* are as follows:

a. information on existing transport networks and travel initiatives for the Deptford Church Street site including shuttle bus services for staff and labour

b. a mode split established for the Deptford Church Street 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 assigned responsibility for managing the *Travel Plan* monitoring and action plans specifically for this site

Other measures during construction

12.2.20 Embedded design measures which are not outlined in the *CoCP* but are relevant to the assessment include the following:

a. removal of the footway/verge at the western end of Crossfield Street in Phase 1 of construction

b. during Phase 2 of construction, removal of the central reservation along Deptford Church Street to accommodate contraflow working as part of traffic management measures (to maintain two-way traffic flow).

Operation

12.2.21 During operation, maintenance vehicles would enter the site from Crossfield Street and exit via Coffey Street using a new access point, as detailed in the Deptford Church Street design principles report Section 4.19 (see Vol 1 Appendix B). 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 year intervals requiring access to enable two mobile cranes and associated support vehicles to be brought to the site, which may require temporary restriction of on-street parking in the vicinity of the site in order for vehicles to access the site.

12.3 Assessment methodology

Engagement

12.3.1 Vol 2 Section 12 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 23 Table 12.3.1.

12.3.2 It was reported in the *Scoping Report* 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 23 Table 12.3.1 Transport – stakeholder engagement

Organisation	Comment	Response
LB of Lewisham, Section 48 consultation, October 2012 Phase two consultation, February 2012	The closure of Deptford Church Street (A2209) northbound and installation of a contraflow on the southbound carriageway will cause congestion.	This has been included within the assessment, the results of which are given in Section 12.5.
LB of Lewisham, Section 48 consultation, October 2012 Phase two consultation, February 2012	The width of the southbound carriageway is insufficient to accommodate two-way traffic.	There is sufficient carriageway to accommodate two 3.25m lanes.
LB of Lewisham, Section 48 consultation, October 2012 Phase two consultation, February 2012	The closure of bus stops without the provision of temporary bus stops will impact bus users.	Bus stops would be provided as detailed in para. 12.5.17 and on the highway layout during construction plans (see separate volume of figures – Section 1).
LB of Lewisham, Section 48 consultation, October 2012 Phase two consultation, February 2012	Construction traffic and cumulative effects from committed developments would have significant effects on the local road network.	Traffic associated with other committed developments in the vicinity of the site has been included within the assessment (see paras. 12.3.6-12.3.8).
LB of Lewisham, Section 48 consultation, October 2012	Parking suspensions on Coffey and Crossfield Street would have an impact on on-street parking.	Parking surveys have indicated that there is ample unused capacity in the local area (see paras. 12.4.63-12.4.64).

Organisation	Comment	Response
Phase two consultation, February 2012		
LB of Lewisham, Section 48 consultation, October 2012 Phase two consultation, February 2012	Concern has been expressed over the safety of pedestrians.	This has been considered within the assessment, being one of the impact criteria assessed.
LB of Lewisham, Section 48 consultation, October 2012 Phase two consultation, February 2012	Swept path analysis has not been undertaken for construction vehicle movements.	As described in Section 12.5, swept path analysis has been undertaken which demonstrates construction vehicles can manoeuvre into/out of the site without obstruction.
LB of Lewisham, Section 48 consultation, October 2012 Phase two consultation, February 2012	Further information and detail is required to understand how parking restrictions during the works would impact on the on-going operation of the businesses and to understand how many employees would potentially be affected.	The maintenance of existing parking provision along Crossfield Street is detailed in para. 12.5.25.
LB of Lewisham, phase two consultation, February 2012	Relocating the bus stop on Deptford Church Street (A2209) and pedestrian diversions will adversely affect Deptford Town Centre.	Pedestrian delay and the effects of the bus stop relocation have been considered as part of the assessment which is detailed in Section 12.5.
Transport for London, phase two consultation, February 2012	Operation of the SRN/TLRN in the vicinity of Deptford Church Street	This has been assessed within the modelling and analysis (see Section 12.5) and discussed with TfL.

Organisation	Comment	Response
Transport for London, phase two consultation, February 2012	Weight restrictions apply on Evelyn Street.	This has been taken into consideration within the proposed construction traffic routing for this site.
Transport for London, phase two consultation, February 2012	TfL expressed a preference for a left in, left out site access strategy from Deptford Church Street using banksmen where lorries need to merge with traffic lanes.	Left in left out from Deptford Church Street is the site access strategy. Use of an appropriate lorry management and control system is set out in the *CoCP Part A*.
Transport for London, phase two consultation, February 2012	Vehicle and pedestrian sightlines will need to be checked for lorry access conflicts.	This has been taken into consideration within the site design.
Transport for London, phase two consultation, February 2012	Pedestrian footway diversions need to be checked for dropped kerbs and other requirements for a safe pedestrian environment.	This has been taken into consideration within the site design.
Transport for London, phase two consultation, February 2012	Use of narrow traffic lanes needs to be looked at in regard to cycle safety.	This has been considered within the assessment (see Section 12.5).
Transport for London, phase two consultation, February 2012	Need to assess effect on bus frequency caused by lane closures.	This has been considered within the assessment (see Section 12.5).
Transport for London, phase two consultation, February 2012	Bus diversions to be implemented only if no alternative.	It is proposed that bus routes would remain along Deptford Church Street (A2209).
Transport for London,	Change to bus route lasting over six months requires a	Noted. However, no bus diversions would be required.

Organisation	Comment	Response
phase two consultation, February 2012	permanent change to the route.	
Transport for London, phase two consultation, February 2012	Traffic diversion would be preferred with single lane in each direction - rather than one-way operation with wider diversion	This has been taken into account in the site design with two way operation maintained along Deptford Church Street (A2209).
Transport for London, phase two consultation, February 2012	Utilisation of the central reservation can maximise available carriageway space.	This has been taken into account in the site design.
Transport for London, phase two consultation, February 2012	Closure effects on the A2 will require assessment.	The effects of the reduced capacity along Deptford Church Street have been taken into account in the modelling, the results of which are reported in Section 12.5.
Transport for London, phase two consultation, February 2012	The use of Convoys Wharf to transport materials by river should be given consideration.	Use of the river has been considered but as described in the *Transport Strategy* is not proposed at this site. Convoys Wharf is currently not a transfer location for excavated material onto river transport owned by existing contractors.
Transport for London, phase two consultation, February 2012	To mitigate the impact on bus service frequency and journey time reliability both an enhanced service frequency (preferred) or a diversion of the route should be considered.	The effect on journey times has been considered as part of the assessment (see Section 12.5). No bus diversion is required.

Baseline

12.3.3 The baseline methodology follows the methodology described in Vol 2 Section 12. There are no site-specific variations for identifying the baseline conditions for this site.

Construction

12.3.4 The assessment methodology for the construction phase follows that described in Vol 2 Section 12. There are no site-specific variations for undertaking the construction assessment of this site.

12.3.5 The effect of all other Thames Tideway Tunnel project sites on the area surrounding the Deptford Church Street site has been take into account within the assessment of the peak year of construction at this site.

12.3.6 As indicated in the site development schedule (see Vol 23 Appendix N), six developments identified within 1km of the Deptford Church Street site would be complete and operational during Site Year 1 of construction. These developments have therefore been included in the construction base case. They comprise:

a. Greenwich Reach East

b. site of old Seagar Distillery

c. Greenwich Industrial Estate

d. Bardsley Lane

e. land opposite North Greenwich Pier

f. land at Stockwell Street and John Humphries House.

12.3.7 The Giffin Street Regeneration Area, Creekside Village East, Convoys Wharf (Phases 1, 2 and 3) and Heathside and Lethbridge Estate would be under construction in Site Year 1 of construction. This means that the transport assessment should consider cumulative effects in relation to those developments under construction at the same time as construction works at the Deptford Church Street site. However, the TfL Highway Assignment Models (HAM) which have been used in the transport assessment have been developed using Greater London Authority (GLA) employment and population forecasts, based on the employment and housing projections set out in the London Plan (Greater London Authority, 2011)[4]. As a result the assessment inherently takes into account a level of future growth and development across London.

12.3.8 This means that the trips associated with the other developments described above within 1km of the Deptford Church Street site which could alter the operation of the transport network in the future are already taken into consideration within the traffic modelling.

Construction assessment area

12.3.9 The extent of the assessment area for the Deptford Church Street site includes the site access from Crossfield Street, site exit onto Coffey Street and their junctions with Deptford Church Street (A2209). The assessment area also includes the junction of Deptford Church Street (A2209) and Creek Road (A200) to the north of the site and the junctions of Deptford Church Street (A2209) with Giffin Street, and with Deptford Broadway (A2), Deptford Bridge (A2), and Brookmill Road (A2210) to the south. The pedestrian crossing on Deptford Church Street (A2209) to the south of the junction with Coffey Street has also been assessed.

12.3.10 These roads and junctions 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].

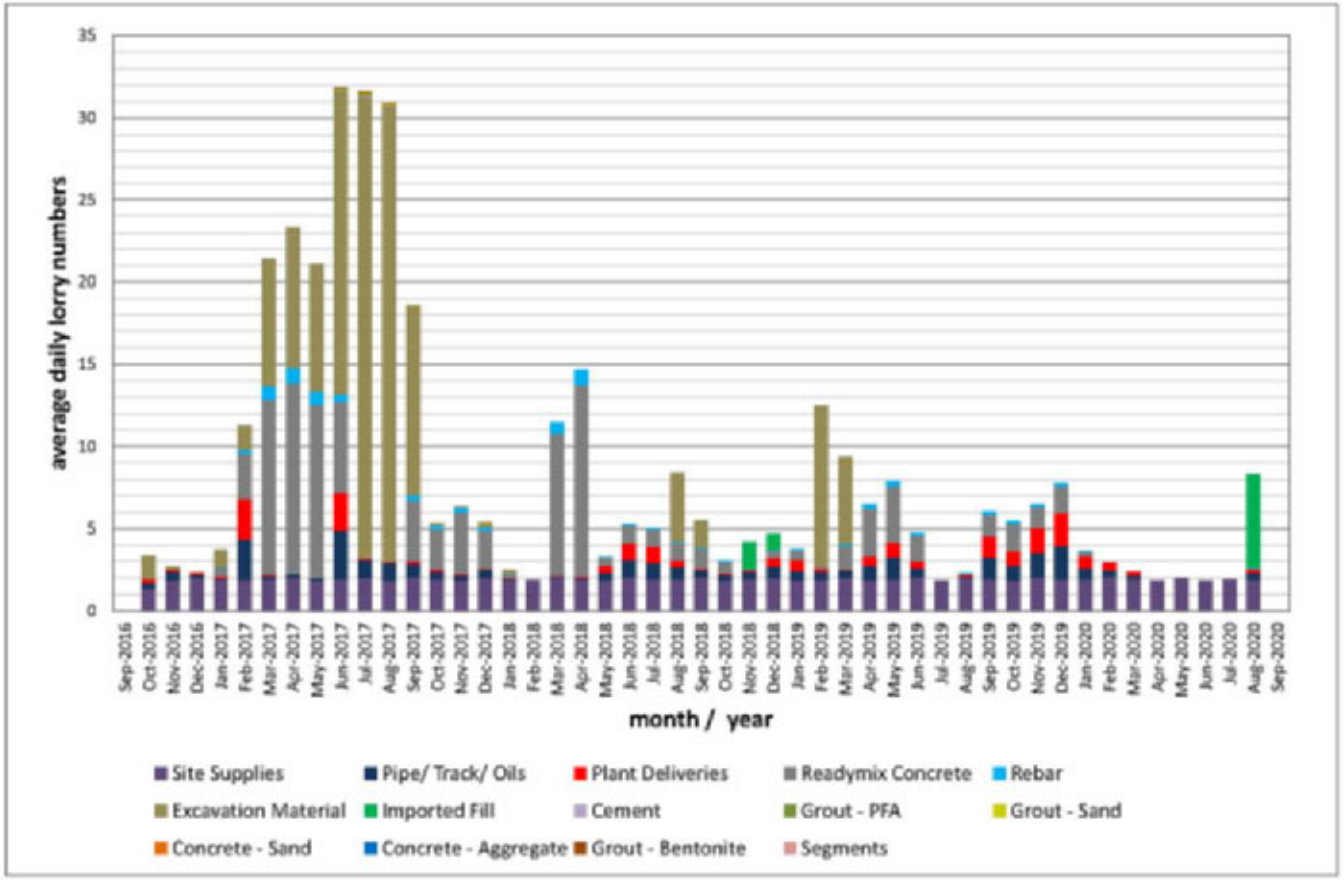
Construction assessment years

12.3.11 A site-specific peak construction assessment year has been identified. The histogram in Vol 23 Plate 12.3.1 shows that the peak site-specific activity at the Deptford Church Street site would occur in Site Year 1 of construction.

12.3.12 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 Volume 2.

Vol 23 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

12.3.13 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.

12.3.14 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:

a. effects on car parking

b. effects on highway layout and operation.

12.3.15 These elements are considered qualitatively (as described in Vol 2 Section 12) because the minimal effect on the highway network means that a quantitative assessment is not required. The scope of this analysis has been discussed with the LB of Lewisham and TfL.

12.3.16 Also, given the level of transport activity associated with the Thames Tideway Tunnel project during the operational phase, only the localised transport effects around the Deptford Church Street site are assessed. Other Thames Tideway Tunnel project sites would not affect the area around Deptford Church Street in the operational phase and therefore they are not considered in the assessment.

12.3.17 With regard to other developments in the vicinity of the site, all the developments detailed in the site development schedule (see Vol 23 Appendix N) would be complete and operational by Year 1 of operation (forming part of the operational base case) with the exception of the Heathside and Lethbridge Estate redevelopment which would still be under construction.

Operational assessment area

12.3.18 The assessment area for the operational assessment remains the same as for the construction assessment as set out in paras. 12.3.9 and 12.3.10.

Operational assessment year

12.3.19 As outlined in Vol 2 Section 12 the operational assessment year has been taken as Year 1 of operation. As transport activity associated with the operational phase is very low, there is no requirement to assess any other year beyond that date.

12.3.20 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

12.3.21 The general assumptions and limitations associated with this assessment are presented in Vol 2 Section 12.

Assumptions

12.3.22 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.

12.3.23 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 Deptford Church Street site, it is assumed that there would be one hazardous load per fortnight generated by the site.

12.3.24 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

12.3.25 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 As shown in Vol 23 Figure 12.4.1 (see separate volume of figures), the site is approximately 600m north of the A2, which forms part of the TLRN. Adjacent to the site is Deptford Church Street (A2209) which forms part of the Strategic Road Network (SRN), as does Creek Road and Norman Road.

Pedestrian routes

12.4.3 The existing pedestrian network and facilities in the vicinity of the site are shown in Vol 23 Figure 12.4.2 (see separate volume of figures).

12.4.4 Coffey Street provides an east-west link for pedestrians between Deptford Church Street (A2209) to the east and Crossfield Street to the west. Footways of between 2.9m and 3.9m wide are provided on both sides of Coffey Street. A raised table pedestrian crossing is provided on Coffey Street at its junction with Deptford Church Street (A2209).

12.4.5 Crossfield Street provides a northwest-southeast link between Deptford High Street to the northwest and Deptford Church Street (A2209) to the southeast. Crossfield Street has footways of between 1m and 1.85m wide on both sides of the road; however, for about 20m of Crossfield Street

from its junction with Deptford Church Street (A2209), a pedestrian footway is only provided on the east side of Crossfield Street.

12.4.6 To the northwest of the site, raised table pedestrian crossings are provided on Crossfield Street where the road meets Coffey Street to promote slow traffic speeds as both St Joseph's Roman Catholic Primary School and St Paul's Church are located in the area.

12.4.7 Deptford Church Street (A2209) has footways of between 3m and 4.3m wide on both sides of the two-way dual carriageway, providing a continuous link between Creek Road (A200) to the north and Deptford Bridge (A2) to the south.

12.4.8 Deptford High Street runs approximately 200m to the west of the site, parallel to Deptford Church Street (A2209) providing a north-south link between Creek Road (A200) and Evelyn Street (A200) to the north and New Cross Road (A2) to the south. The road has footways of approximately 2.7m wide on both sides.

12.4.9 The Thames Path is approximately 600m walking distance to the north of the site. The Thames Path runs along Borthwick Street and continues to the east along the River Thames and Glaisher Street, and to the west along Watergate Street and Prince Street.

Cycle facilities and routes

12.4.10 The existing cycle network and facilities in the vicinity of the site are shown in Vol 23 Figure 12.4.2 (see separate volume of figures).

12.4.11 There are no strategic cycle routes in the immediate vicinity of the site; however, bus lanes are provided along Deptford Church Street (A2209), northbound and southbound, which can be shared by cyclists.

12.4.12 The nearest National Cycle Network (NCN) to the site is NCN Route 21 (on road) which runs from Greenwich southwards to Crawley, then east to Groombridge and south to Eastbourne and Pevensey.

12.4.13 The NCN Route 21 in the immediate vicinity of the site runs along Creekside approximately 220m to the east of the site and continues north along Copperas Street, connecting to NCN Route 4 on Creek Road (A200) approximately 375m to the northeast of the site. NCN Route 21 continues south turning onto Deptford Church Street (A2209) at the Deptford Church Street (A2209), Creekside and Reginald Road roundabout to the south of the site.

12.4.14 Four cycle stands are provided approximately 545m walking distance from the site along Bronze Street, to the west of the junction with Creekside, accommodating up to eight bicycles. A further cycle stand is located outside Deptford Rail Station, which is approximately 300m walking distance to the west of the site.

12.4.15 Currently, there is no Cycle Superhighway or any cycle hire docking stations in the vicinity of the site.

Public Transport Accessibility Level

12.4.16 The Public Transport Accessibility Level (PTAL) of the site has been calculated using TfL's approved PTAL methodology (TfL, 2010)[5] 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).

12.4.17 Using this methodology the site has a PTAL rating of 4, rated as 'moderate' (with 1 being the lowest accessibility and 6b being the highest accessibility).

12.4.18 Vol 23 Figure 12.4.3 (see separate volume of figures) shows the public transport network around the Deptford Church Street site.

Bus routes

12.4.19 As shown in Vol 23 Figure 12.4.3 (see separate volume of figures), a total of six daytime bus routes operate within 640m of the site serving local destinations. There are also a total of three night bus routes which operate within a 640m walking distance of the site.

12.4.20 These bus routes operate from the following bus stops:

a. Wavelengths bus stop on Deptford Church Street (A2209), northbound and southbound, 170m to the south

b. MacMillan Student Village bus stop on Creek Road (A200), eastbound and westbound, 340m to the northeast

c. Deptford Bridge bus stop on Deptford Bridge (A2), eastbound and westbound, 675m to the southeast

12.4.21 These routes would also serve other stops further from the site as shown on Vol 23 Figure 12.4.3 (see separate volume of figures).

12.4.22 On average there are 85 daytime bus services per hour in total in the AM peak and 87 bus services per hour in total in the PM peak within a 640m walking distance of the site.

12.4.23 There are approximately ten night-time bus services per hour in total Monday – Friday between 00:00 – 06:00 and 15 bus services per hour in total on Saturdays between 00:00 – 06:00 within a 640m walking distance of the site.

Docklands Light Railway (DLR)

12.4.24 As shown on Vol 23 Figure 12.4.3 (see separate volume of figures), Deptford Bridge Docklands Light Railway (DLR) station is the closest DLR station to the Deptford Church Street site and is located approximately 600m walking distance to the south. The station provides access direct to Bank to the north and Lewisham to the south.

12.4.25 During the week, the DLR service to Lewisham starts at 05:30 running until 00:30 with the frequency of approximately every two to four minutes during the AM peak hour and every four minutes during the PM peak hour.

12.4.26 During the AM and PM peak hours an average of 15 services run to Lewisham and 15 services to Bank from Deptford Bridge.

12.4.27 The same services can also be accessed at Cutty Sark and Greenwich DLR stations, approximately 690m and 890m walking distance to the northeast and east of the site respectively.

National Rail

12.4.28 The closest National Rail station to the site is Deptford, located approximately 300m walking distance to the west.

12.4.29 Deptford station provides access to Southeastern train services to and from Dartford, Slade Green, Crayford, London Charing Cross, London Cannon Street and London Bridge.

12.4.30 In the AM peak hour there are approximately 12 services in total. In the PM peak hour there are approximately 11 services in total.

Parking

12.4.31 Vol 23 Figure 12.4.4 (see separate volume of figures) shows the locations of existing car parks and car club spaces within the vicinity of the site.

Existing on-street car parking

12.4.32 Coffey Street which borders the site to the north has 14 unrestricted parking bays, Crossfield Street which borders the site to the south has unmarked kerbside capacity for 39 cars. Deptford Church Street (A2209) has unmarked kerbside parking for five cars located outside the Birds Nest Pub approximately 400m walking distance from the site.

12.4.33 There are 26 car parking bays along Deptford High Street with a maximum stay of 30 minutes. Bronze Street has five unrestricted marked parking bays, in addition Bronze Street and Creekside have capacity for 285 vehicles in the form of unmarked kerbside parking 250m walk east of the site.

12.4.34 Along Giffin Street 13 bays are provided for resident permit holders. Pay and display parking is available along both sides of Frankham Street with 111 parking bays, in addition a further eight bays are available on Frankham Street for blue badge holders.

Existing off-street/private car parking

12.4.35 The closest off-street car park to the site is located on Frankham Street, approximately 400m walking distance to the south of the site. This is a shared use car park which can be used by pay and display users and permit holders. The car park provides 49 parking bays and one blue badge holder parking bay.

Car clubs

12.4.36 The closest car club parking space to the site is operated by Zipcar and is approximately 485m walking distance away on Reginald Road where one car space is provided.

Servicing and deliveries

12.4.37 A loading bay is located along Creekside approximately 320m walking distance south of the junction with Bronze Street. It is 15.5m long which accommodates up to two lorries. No time restriction or charge applies to this bay.

Highway network and operation

12.4.38 The site is bounded by Coffey Street to the north, Crossfield Street to the south and to the west, and Deptford Church Street (A2209) to the east.

12.4.39 Crossfield Street southwest of the site is a two-way road with a 30mph speed limit, which meets Coffey Street at a turning area that accommodates a drop off / pick up area for the local school and links to Deptford High Street to the west. The part of Crossfield Street located to the south of the site is a no through route accessed from Deptford Church Street (A2209) only. A 30mph speed limit applies to this road.

12.4.40 Coffey Street is a 20mph zone which links Deptford Church Street (A2209) and Deptford High Street, two-way access is provided from Deptford Church Street (A2209). The access from Deptford High Street is one-way, allowing entry only, with exit via Deptford Church Street (A2209).

12.4.41 Deptford Church Street (A2209) is subject to a 30mph speed limit and forms part of the SRN, it is a dual carriageway with one general traffic lane and a bus lane both northbound and southbound. The road leads to Creek Road (A200), also with a 30mph speed limit to the north, which also forms part of the SRN. Deptford Church Street separates into two lanes and a bus lane on the northbound approach to the signalised junction with Creek Road (A200) and two lanes on the southbound approach.

12.4.42 Deptford Church Street (A2209) links to Deptford Bridge (A2) and Brookmill Road both subject to a 30mph speed limit to the south at a signalised junction. The road separates into three lanes on the southbound approach and two lanes on the northbound exit. Deptford Bridge (A2) forms part of the TLRN.

12.4.43 Deptford High Street a 30mph road runs in a north-south direction to the west of the site, and accommodates two-way traffic movements between the junction with Creek Road (A200), Evelyn Street (A200) both part of the SRN and Watergate Street in the north and the junction with Giffin Street. Giffin Street is a two-way road and subject to a 20mph speed limit.

12.4.44 Between the junction with Giffin Street and the junction with Deptford Bridge (A2), the High Street is a one-way southbound route.

Data from third party sources

Description of data

12.4.45 Data in relation to traffic flows and accidents have been sourced from TfL.

Accident analysis

12.4.46 A total of two serious accidents and 17 slight accidents occurred in the assessment area over the five years of accident data analysed. There were no fatal accidents.

12.4.47 In total, 18 accidents occurred along Deptford Church Street (A2209) between the junction with Creek Road (A200) and the junction with Giffin Street. Two accidents were classified as serious and 16 as slight.

12.4.48 A total of five accidents involved cyclists within the assessment area, all of which were classified as slight. Two pedestrians were involved in slight accidents.

12.4.49 Of the total accidents, four accidents involved light good vehicles (LGVs) and one accident involved a medium good vehicle (MGV). The accidents involved LGVs were slight accidents and the accident involving a MGV was a serious accident.

12.4.50 There is no evidence of accidents occurring due to highway geometry or poor infrastructure.

Data analysis

12.4.51 TfL carried out a survey at the junction of Deptford Broadway (A2) and Deptford Bridge (A2) with Brookmill Road (A2210) and Deptford Church Street (A2209). Analysis of this data identified the two-way traffic flows along Deptford Church Street (A2209) in 2010. This showed that the weekday AM peak hour two-way traffic flows were 1,313 vehicles and the PM peak hour two-way traffic flows were 1,371 vehicles.

12.4.52 The analysis of this data was undertaken and the information used to validate the traffic surveys undertaken in 2011.

Survey data

Description of surveys

12.4.53 Baseline survey data were collected in May, June, and July 2011 to establish the existing transport movements and parking usage in the area. Volume 23 Figure 12.4.5 (see separate volume of figures) shows the survey locations in the vicinity of the site.

12.4.54 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, saturation flows, degree of saturation and traffic signal timings. Parking surveys were undertaken to establish the usage of pay and display parking, unrestricted parking and loading bays.

Results of the surveys

12.4.55 The surveys inform the baseline situation in the area surrounding the site.

Pedestrians and cyclists

12.4.56 Pedestrian surveys around the site during the AM and PM peak hours indicate that there is a relatively balanced flow of pedestrians during the AM peak hour along the western footway of Deptford Church Street (A2209) crossing the junction with Coffey Street with approximately 15 travelling north and 19 travelling south. The flow is similarly balanced during the PM peak hour with approximately 30 pedestrians travelling north and 26 south.

12.4.57 Regarding flows of bicycles along the main routes surrounding the site, there is a reasonably heavy flow of cyclists travelling along Deptford Church Street (A2209) during the AM and PM peak hours. During the AM

peak hour an average of 142 cyclists head north and during the PM peak hour an average of 84 head south.

Traffic flows

12.4.58 Automatic traffic count (ATC) data collected as part of the surveys have been analysed to identify the existing traffic flows along Deptford Church Street (A2209). Weekday flows have been used as this is when the greatest impacts from the project are likely to be experienced. The weekday vehicle and HGV flows for a 12-hour period (07:00-19:00) show that the PM peak for Deptford Church Street (A2209) is the busiest hour with a maximum two-way flow of approximately 300 vehicles every 15 minutes (160 vehicles in the northbound direction and 140 vehicles in the southbound).

12.4.59 Traffic surveys indicate that there is a total traffic flow of 1,998 and 2,457 vehicles in the AM and PM peak hours respectively using the junction of Creek Road (A200) and Deptford Church Street (A2209) with a predominant traffic flow along the westbound carriageway of Creek Road (A200) in the AM peak hour and along the eastbound carriageway of Creek Road (A200) in the PM peak hour.

12.4.60 A total traffic flow of 552 and 723 vehicles use the junction of Deptford Church Street (A2209) and Coffey Street in the AM and PM peak hours respectively. At the junction of Deptford Church Street (A2209) and Giffin Street, a total traffic flow of 1,255 and 1,722 vehicles use the junction in the AM and PM peak hours respectively. The predominant flows at these junctions are along Deptford Church Street (A2209).

12.4.61 A total traffic flow of 3,360 vehicles use the junction of Deptford Bridge (A2), Deptford Broadway (A2), Deptford Church Street (A2209) and Brookmill Road (A2210) in the AM peak hour with predominant flows along the westbound carriageway of Deptford Bridge (A2). In the PM peak hour, the total flow is 3,609 and the predominant flows are along the eastbound carriageway of Deptford Broadway (A2). The PM peak hour for Deptford Church Street (A2209) is the busiest hour with a maximum two-way flow of approximately 1,493 vehicles. During the AM peak hour there is a two-way flow of approximately 1,375 vehicles.

12.4.62 The traffic flows for the busiest period within the area are indicated in Vol 23 Figure 12.4.6 and Vol 23 Figure 12.4.7 (see separate volume of figures).

Parking

12.4.63 Surveys were undertaken to establish the availability of pay and display and unrestricted parking in the vicinity of the site to understand existing occupancy and capacity. Results indicate there is ample capacity surrounding the site, as the spaces are not heavily used for the majority of the day.

12.4.64 The maximum occupancy of the unrestricted parking bays on Coffey Street was 50% and the maximum occupancy of the available kerbside space for 39 cars along Crossfield Street was 67%.

Servicing

12.4.65 The results of the surveys indicate that usage of loading bay on Creekside is low, with spare capacity available on both weekdays and at weekends.

Local highway modelling

12.4.66 To establish the existing capacity on the local highway network, a scope was discussed with TfL and the LB of Lewisham to model the following five junctions in the vicinity of the site using the TRANSYT model:

a. Creek Road (A200) and Deptford Church Street (A2209)

b. Deptford Church Street (A2209) and Coffey Street

c. Deptford Church Street (A2209) and Crossfield Street

d. Deptford Church Street (A2209) and Giffin Street

12.4.67 A LinSig model has been used to examine the existing capacity of the Deptford Broadway (A2)/ Deptford Bridge (A2)/ Deptford Church Street (A2209) and Brookmill Road (A2210) junction.

12.4.68 In addition, the pedestrian crossing on Deptford Church Street (A2209) to the south of the junction with Coffey Street has also been included in the TRANSYT model.

12.4.69 The baseline model incorporates the current traffic and transport conditions within the vicinity of the site and followed the methodology outlined in Vol 2 Section 12.

12.4.70 The weekday AM and PM baseline model flows for Deptford Church Street (A2209) at each junction were compared against observed queue lengths for the peak periods to validate the TRANSYT and LinSig models and to ensure a reasonable representation of existing conditions.

Vol 23 Table 12.4.1 Transport – baseline TRANSYT model outputs for junctions at north end of Deptford Church Street (A2209)

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (seconds)	Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (Sseconds)
Junction of Creek Road (A200) and Deptford Church Street (A2209)									
Creek Road (A200) - westbound	Left	46	30%	1	47	62	26%	2	39
	Left (Buses)	10	30%	1	47	10	26%	2	39
	Ahead (middle lane)	234	61%	17	22	162	43%	9	27
	Ahead (offside lane)	700	61%	17	22	292	43%	9	27
Creek Road (A200) - eastbound	Ahead (nearside lane)	191	20%	2	7	408	57%	8	13
	Ahead (middle lane)	190	20%	2	7	408	57%	8	13
	Right	372	40%	8	27	563	49%	11	23
	Right (Buses)	26	40%	8	27	68	49%	11	23
Deptford Church Street (A2209) - northbound	Left (nearside lane)	73	9%	0	10	49	5%	1	11
	Left (middle lane)	349	22%	2	10	535	26%	12	13
	Right	12	7%	0	29	88	32%	2	52
		PRC		**Total delay (PCU hours)**		**PRC**		**Total delay (PCU hours)**	
Overall junction performance		48%		11.43		58%		14.52	

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (seconds)	Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (Sseconds)
Deptford Church Street (A2209) pedestrian crossing near Coffey Street									
Deptford Church Street (A2209) - northbound	Ahead (nearside lane)	73	5%	0	1	49	3%	0	1
	Ahead (offside lane)	360	24%	0	2	560	36%	1	2
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	36	2%	0	1	78	5%	1	6
	Ahead (offside lane)	418	27%	0	2	625	40%	10	12
		PRC		**Total delay (PCU hours)**		**PRC**		**Total delay (PCU hours)**	
Overall junction performance		223%		0.46		125%		2.08	
Junction of Deptford Church Street (A2209) and Coffey Street									
Deptford Church Street (A2209) - northbound	Ahead	360	19%	0	1	593	31%	9	2
	Ahead / left	73	4%	0	1	49	3%	0	1
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	36	2%	0	1	78	4%	0	1
	Ahead (offside lane)	418	21%	4	1	625	32%	8	2
Coffey Street	Left	38	6%	0	3	39	7%	0	3
		PRC		**Total delay (PCU hours)**		**PRC**		**Total delay (PCU hours)**	
Overall junction performance		329%		0.28		181%		0.74	

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (seconds)	Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (Sseconds)
Junction of Deptford Church Street (A2209) and Crossfield Street									
Deptford Church Street (A2209) - northbound	Ahead / left	73	4%	0	1	49	3%	0	1
	Ahead	358	18%	0	1	550	28%	10	3
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	36	2%	0	1	78	4%	0	1
	Ahead (offside lane)	418	21%	0	1	625	32%	0	1
Crossfield Street	Left	22	4%	0	3	10	2%	0	3
		PRC		**Total delay (PCU hours)**		**PRC**		**Total delay (PCU hours)**	
Overall junction performance		329%		0.26		181%		0.68	
Junction of Deptford Church Street (A2209) and Giffin Street									
Deptford Church Street (A2209) - northbound	Ahead / left	381	53%	7	23	300	57%	6	32
	Ahead	348	43%	6	21	305	52%	6	30
Deptford Church Street (A2209) - southbound	Ahead / right	418	52%	4	18	625	106%	39	160
	Ahead	36	4%	0	18	78	13%	1	12
Giffin Street	Left / right	35	17%	1	42	468	106%	30	181
		PRC		**Total delay (PCU hours)**		**PRC**		**Total delay (PCU hours)**	

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (seconds)	Flow (PCU)	DoS	MMQ (PCU)	Delay per PCU (Sseconds)
Overall junction performance		70%		7.14		-18%		56.78	

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 PCUs and pedal cycles are 0.2 PCUs.

Vol 23 Table 12.4.2 Transport – baseline LinSig model outputs for Deptford Broadway (A2) / Deptford Bridge (A2) / Deptford Church Street (A2209) / Brookmill Road (A2210)

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow	DoS	MMQ (vehicles)	Delay (seconds)	Flow	DoS	MMQ (vehicles)	Delay (seconds)
Deptford Church Street (A2209) - southbound	Left	253	19%	1	8	375	32%	3	14
	Ahead / right	313	65%	7	37	397	65%	9	36
Deptford Bridge (A2)	Ahead / left	686	82%	14	32	565	77%	8	26
	Ahead / right	686	76%	9	30	566	99%	17	91
Brookmill Road (A2210)	Ahead / left /right	469	85%	12	48	461	78%	12	42
Deptford Broadway (A2)	Ahead (nearside lane)	89	22%	2	32	114	19%	2	26
	Ahead (middle lane)	311	70%	7	42	427	64%	10	33
	Ahead / right	435	89%	11	60	575	82%	13	43
	Left	120	21%	1	4	130	22%	1	4
		PRC		Total delay (PCU hours)		PRC		Total delay (PCU hours)	
Overall junction performance		1.2%		33.47		-9.6		40.67	

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 PCUs and pedal cycles are 0.2 PCUs

12.4.71 Vol 23 Table 12.4.1 shows the modelling outputs for the baseline case for the four junctions at the north end of Deptford Church Street (A2209).

12.4.72 The results indicate that all the junctions operate within capacity during the AM and PM peak hours with the exception of the junction of Deptford Church Street (A2209) and Giffin Street and the junction of Deptford Broadway (A2) / Deptford Bridge (A2) / Deptford Church Street (A2209) / Brookmill Road (A2210) which both operate above capacity during the PM peak hour.

12.4.73 At the junction of Deptford Church Street (A2209) and Creek Road (A200) the Creek Road (A200) westbound ahead movements are the busiest operating at 61% capacity and the greatest delay is found on the Creek Road (A200) westbound left movement with an average of 47 seconds during the AM peak hour. During the PM peak hour the Creek Road (A200) eastbound ahead movement is the busiest operating at 57% capacity, the greatest delay occurs on the Deptford Church Street (A2209) northbound right turn movement with an average delay of 52 seconds.

12.4.74 At the pedestrian crossing along Deptford Church Street (A2209) to the south of Coffey Street the Deptford Church Street (A2209) southbound offside lane is the busiest operating at 27% capacity with an average delay of two seconds. During the PM peak hour the same movement operates at 40% capacity with a delay of 12 seconds.

12.4.75 At the junction of Deptford Church Street (A2209) and Coffey Street the Deptford Church Street (A2209) southbound offside lane is the busiest operating at 21% in the AM peak hour. During the PM peak hour the Deptford Church Street (A2209) southbound offside lane is the busiest operating at 32%. In both the AM and PM peak hours the greatest delay is on the Coffey Street left movement with an average delay of three seconds.

12.4.76 At the junction of Deptford Church Street (A2209) and Crossfield Street the Deptford Church Street (A2209) southbound offside lane is the busiest operating at 21% in the AM peak hour. During the PM peak hour the Deptford Church Street (A2209) southbound offside lane is the busiest operating at 32%. During both the AM and PM peak hours, the greatest delay is on the Crossfield Street left movement with an average delay of three seconds.

12.4.77 At the junction of Deptford Church Street (A2209) and Giffin Street the Deptford Church Street (A2209) northbound ahead and left movement is the busiest operating at 53% capacity. The Giffin Street left and right movement experiences the greatest delay with an average of 42 seconds. During the PM peak hour the Deptford Church Street (A2209) southbound ahead and right and the Giffin Street left and right movements are the busiest operating above capacity at 106%. The greatest delay is experienced on the Giffin Street arm with an average delay of 181 seconds.

12.4.78 Vol 23 Table 12.4.2 shows the outputs of the validated model for the junction of Deptford Broadway (A2), Deptford Bridge (A2), Deptford Church Street (A2209) and Brookmill Road (A2210). The junction operates

close to capacity in the AM peak hour and above capacity during the PM peak hour. During the AM peak hour the Deptford Broadway (A2) ahead and right movement operates at 89% capacity and experiences a delay of approximately 60 seconds. During the PM peak hour the Deptford Bridge (A2) ahead and right movement operates at 99% capacity and experiences a delay of approximately 91 seconds.

Transport receptors and sensitivity

12.4.79 The transport receptor sensitivity is defined as high, medium or low using the criteria detailed in Vol 2 Section 12. Vol 23 Table 12.4.3 indicates the receptors and their sensitivities for the Deptford Church Street site.

12.4.80 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.

12.4.81 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 23 Table 12.4.3 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 Coffey Street, Crossfield Street or Deptford Church Street for access and as a through route	Construction	High sensitivity to footway closures and diversions, resulting in increases to journey times.
Private vehicle users in the area using the local highways or on-street	Construction Operation	Medium sensitivity due to journey time delays as a result of increases

[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
parking		to traffic flows
Emergency vehicles using the road network within the local area	Construction Operation	High sensitivity to journey time delays due to time constraints on journey purposes
Service vehicles using loading bay on Creek Road (A200)	Construction	Low sensitivity due to distance from the site
Bus passengers using services along Deptford Church Street (A2209)	Construction	Medium sensitivity due to journey time delays as a result of increases to traffic flows
Public transport users using rail services within the area	Construction	Low sensitivity due to distance from site and low numbers of construction workers
Pupils, parents and staff at St Joseph's Roman Catholic Primary School, 10m west of the site (access from Deptford High Street/Crossfield Street or Coffey Street) Users of St Paul's Church, 30m north of the site (accessed from Coffey Street) Users of the playground, 85m to the north of the site (vulnerable users (children) are present)	Construction	High sensitivity due to increases in HGV traffic and changes to pedestrian environment resulting in journey time delays
Residents and users of Giffin Street Regeneration Area mixed use development	Construction	Medium sensitivity due to increases in HGV traffic and changes to pedestrian environment

Receptors (relating to all identified transport effects)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
(completed section), 50m to the south of the site Residential area, 46m to the east of the site		resulting in journey time delays
Business and workplace occupiers at Crossfield Street (warehouses, located 10m south of the site, which use Crossfield Street for access)	Construction	Medium sensitivity due to increases in HGV traffic and changes to pedestrian environment resulting in journey time delays and parking
Users of the Wavelengths Leisure Centre, 30m south of the site	Construction	Low sensitivity due to increases in HGV traffic and changes to pedestrian environment resulting in journey time delays

Construction base case

12.4.82 As described in Section 12.3 above, the construction assessment year for transport effects in relation to the site is Site Year 1 of construction.

12.4.83 There are no proposals to change the pedestrian network by Site Year 1 of construction and the network will operate as indicated in the baseline situation.

12.4.84 It is proposed that there would be changes to the cycling network by Site Year 1 of construction. Cycle Superhighway CS4 is a planned future route running between Woolwich and London Bridge which is expected to open by Site Year 1 of construction. The route runs along Creek Road (A200), approximately 200m to the north of the site. By 2013, Cycle Superhighway CS5 will also have opened, running from Lewisham to Victoria. It will travel east to west in the area of the A2, some 565m to the south of the site.

12.4.85 In terms of the public transport network, there are no London Underground services in the vicinity of the Deptford Church Street site and there are no specific commitments to improvements to the DLR or National Rail networks that would affect this site. It is envisaged that London Underground and National Rail patronage will increase by Site Year 1 of construction.

12.4.86 In order to ensure that the busiest base case scenario is used in the assessment, the capacity for National Rail and DLR 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.

12.4.87 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 Deptford Church Street 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 23 Figure 12.4.6 and Vol 23 Figure 12.4.7 (see separate volume of figures).

12.4.88 The key findings from the construction base case model for Deptford Church Street (A2209) indicate that there will be changes in queue lengths and to average delays at the junctions along Deptford Church Street (A2209) in the construction base case, compared to baseline conditions. In some arms the queue and the delay per vehicle will reduce despite the traffic growth in the construction base case in comparison to the baseline situation mainly as a result of the optimisation of the traffic signal timings as detailed in Vol 2 Section 12.

12.4.89 Results indicate that the local network will operate mostly within capacity, when taking into account the construction base case traffic flows.

12.4.90 The base case in Site Year 1 of construction takes into account the developments described in the site development schedule (see Vol 23 Appendix N). With regard to the identification of additional receptors associated with the other developments, there are two developments within 250m of the site which are relevant to the transport assessment. These are the Giffin Street Master plan Area and Creekside Village East. However, only Creekside Village East represents a new receptor as part of the Giffin Street Regeneration Area development is already complete, meaning that it is considered as a baseline receptor (see Vol 23 Table 12.4.3). Impacts could be experienced by employees, residents and visitors at the Creekside Village East development using the footways and the local highway network in the vicinity of the site and on this basis it has been taken into consideration as a receptor in the assessment as shown in Vol 23 Table 12.4.4.

Vol 23 Table 12.4.4 Transport – construction base case additional receptors

Receptors (relating to developments within 1km of the site)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
Residents and users of Creekside Village East, 220m northeast of the site	Construction	Medium sensitivity due to increases in HGV traffic and changes to pedestrian environment resulting in journey time delays

Operational base case

12.4.91 The operational base assessment year for transport is Year 1 of operation.

12.4.92 As explained in para. 12.3.14, the elements of the transport network that would be affected during operation are highway layout and operation and parking. For the purposes of the operational base case, it is anticipated that the highway layout and parking will be as indicated in the construction base case.

12.4.93 The operational base case takes account of the developments described in the site development schedule (see Vol 23 Appendix N). Given the nature of the developments it is not however necessary to consider them as receptors in the transport assessment of operational effects.

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 Deptford Church Street 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[iv] journey to work data for the area in the vicinity of the Deptford Church Street site. The Census data indicates that the predominant mode of travel for journeys to work in this area is car; however, as parking on surrounding streets is restricted, and measures to reduce car use would be incorporated into site-specific *Travel Plan* requirements, it is expected that the number of construction workers driving to the site would in reality be much lower.

12.5.3 The mode split outlined in Vol 23 Table 12.5.1 has been used to assess the impacts of worker journeys on the highway and public transport networks.

[iv] Based on 2001 Census as this type of data had not been released from the 2011 Census at the time of assessment.

Vol 23 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	14%	6	6
National Rail	12%	5	5
Underground	0%	0	0
DLR	8%	3	3
Car driver	50%	20	20
Car passenger	3%	1	1
Cycle	3%	1	1
Walk	9%	4	4
River	0%	0	0
Other (taxi/motorcycle)	2%	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 pedestrian footways during construction.

12.5.5 During phase 1 of construction there would be no change to pedestrian routes surrounding the site.

12.5.6 During phase 2 of construction approximately 80m of the western footway of Deptford Church Street (A2209) would be closed to accommodate the construction works. The site also encompasses an amenity area, which would be closed throughout construction. During this time, pedestrians would be diverted to the north footway of Coffey Street and the south footway of Crossfield Street. Pedestrians would be able to use the raised table pedestrian crossings on Crossfield Street to the west of the site to cross the road.

12.5.7 Using the mode split of worker trips shown in Vol 23 Table 12.5.1 above, it is anticipated that 43% of worker trips would be made by foot, this includes all those travelling by National Rail, DLR and bus who would complete their journeys by foot.

12.5.8 Taking into consideration the pedestrian diversions the greatest effect would be on the eastern footway along Deptford Church Street (A2209) where pedestrians would be diverted from the closed western footway of Deptford Church Street (A2209).

12.5.9 It is anticipated that the pedestrian diversions around the Deptford Church Street site would result in a total journey time increase of approximately two minutes 45 seconds for those heading north and south on the western footway of Deptford Church Street (A2209), due to pedestrians being required to cross onto the eastern footway and extend their journey by 190m.

12.5.10 Pedestrians wishing to cross Deptford Church Street (A2209) to or from Coffey Street heading east or west, would have to use the relocated pedestrian crossing 25m north of Berthon Street. They would experience a total increase of approximately one minute 45 seconds, due to an increased distance of 133m.

12.5.11 In determining the magnitude of impacts on pedestrian routes, the relevant impact criteria are pedestrian delay, pedestrian amenity and accidents and safety (as set out in Vol 2 Section 12).

12.5.12 The footway closures and diversions resulting in an increased walking distance along Deptford Church Street (A2209) would result in a conservative impact magnitude of medium adverse for pedestrian delay.

12.5.13 With regard to pedestrian amenity and accidents and safety, the closure of a section of the west side of Deptford Church Street (A2209) footway would result in pedestrians having to make one additional road crossing onto the opposite side of the road. Although the number of construction HGV movements would be between four and 20 movements per hour, the impact magnitude for pedestrian amenity and accidents and safety would be high adverse due to the pedestrian route requiring an additional road crossing.

Cycle facilities and routes

12.5.14 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).

12.5.15 Cyclists using the highway would experience an additional delay to journey time as a result of the construction works at the Deptford Church Street site. The effect on journey times is identified in the highway operation and network assessments and would be an increase of a maximum of some 49 seconds over that in the construction base case. This represents a negligible impact.

12.5.16 With regard to accidents and safety, while cyclists would not be required to make any additional road crossings due to highway and lane adjustments along Deptford Church Street (A2209), here would be an increase in construction traffic flow of between four and 20 two-way HGV movements per hour. This represents a low adverse impact.

Bus routes and patronage

12.5.17 As shown in Vol 23 Figure 12.4.3 (see separate volume of figures), four bus stops on Deptford Church Street (A2209) would require relocation during Phase 2 of construction for the CSO interception works. The northbound and southbound bus stops along Deptford Church Street

(A2209) to the north of the junction with Coffey Street would be moved approximately 100m north of the junction with Bronze Street. To the south of the junction of Deptford Church Street (A2209) and Crossfield Street, both the northbound and southbound bus stops would be relocated approximately 30m further to the south

12.5.18 During phase 2 of construction, the bus lanes in both the north and southbound directions would also be temporarily suspended to enable two-way single carriageway working for all traffic along Deptford Church Street (A2209). The effect on journey times is detailed under the highway operation and network assessment and would result in a road network delay of less than one minute.

12.5.19 In determining the magnitude of impacts, the relevant impact criteria with respect to the assessment of bus routes are road network delay and bus patronage (as set out in Vol 2 Section 12).

12.5.20 Due to the road network delay being less than one minute per km of route assessed, in accordance with the Vol 2 Section 12, this equates to a negligible impact.

12.5.21 It is expected that approximately six 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 85 buses during the AM peak hour and 87 in the PM peak hour within a 640m walking distance).

12.5.22 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.

DLR and National Rail and patronage

12.5.23 No rail stations are directly adjacent to the site and therefore none would be directly affected by the construction works at the site. It is anticipated that approximately five construction workers and labourers would use National Rail services to access the site which would result in less than one additional person trip on National Rail services in each of the AM and PM peak hours. In regard to DLR trips it is estimated that three construction workers and labourers would use DLR services to access the site. This would result in less than one additional person trip per DLR service during the AM and PM peak hours.

12.5.24 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 DLR and National Rail patronage.

Parking

12.5.25 The construction site would require the temporary restriction of eight on-street parking spaces along Coffey Street and the prohibition of unmarked kerbside parking capacity along Crossfield Street during construction to enable lorries to access and leave the site. This is shown in the highway layout during construction plans (see separate volume of figures – Section 1). Parking along Crossfield Street would not be restricted from the site

access to the newly created junction of Crossfield Street and Coffey Street, this would maintain parking capacity for services in the local area.

12.5.26 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* and *CoCP*. However, using the 2001 census data, 20 workers could be expected to drive to the Deptford Church Street site per day.

12.5.27 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).

12.5.28 The construction work at the Deptford Church Street site would result in a low adverse impact on parking, as the restriction of parking on Coffey Street and Crossfield Street would be offset by adequate spare parking capacity in the local area (see paras. 12.4.63-12.4.64).

12.5.29 There is anticipated to be a negligible impact on the loading bay on Creekside due to the distance from the site.

Highway network and operation

12.5.30 The highway layout during construction plans (see separate volume of figures – Section 1) shows that the site is on the western side of Deptford Church Street (A2209) and would be accessed from the northbound lane via Crossfield Street. The highway layout during construction vehicle swept path analysis plan (see Deptford Church Street *Transport Assessment* figures) demonstrates that the construction vehicles are able to safely enter and leave the site.

12.5.31 During phase 1 of construction, Coffey Street and Crossfield Street would be linked to the northwest of the site to allow through traffic access between the two. One way working would apply with entry from Deptford Church Street (A2209) via Crossfield Street and exit from Coffey Street to Deptford Church Street (A2209). Deptford Church Street (A2209) would operate as in baseline conditions.

12.5.32 Phase 2 of construction would require closure of the two northbound lanes of Deptford Church Street along the eastern boundary of the site. The traffic management measures for this phase would use the southbound carriageway as a two-way single-lane carriageway for the duration of the construction work, with a minimum lane width of 3.25m being maintained in both directions. To accommodate these measures, the northbound and southbound bus lanes along Deptford Church Street would be suspended and three bus stops would be relocated as detailed in para 12.5.17. In addition the pedestrian crossing to the south of Coffey Street would be relocated to the north.

12.5.33 The westbound lane of Coffey Street would be closed with the eastbound lane operating in a one way direction to allow exit only, with a width of 3.25m. Crossfield Street would operate on an entry only basis.

12.5.34 There would be a gated access for the right-turn in / right-turn out movement for construction traffic entering the site from Crossfield Street and exiting onto Coffey Street. 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). 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.

12.5.35 Vol 23 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 table also shows the construction worker vehicle movements expected to be generated by the site.

12.5.36 The Census data indicates that the predominant mode of travel for journeys to work for this site is car; however, as parking on surrounding streets is restricted, and measures to reduce car use would be incorporated into site-specific *Travel Plan* requirements, the number of construction workers driving to the site is expected to be much lower.

12.5.37 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 *COCP*.

Vol 23 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%*	64	0	7	7	0
Other construction vehicle movements**	36	4	4	4	4
Worker vehicle movements***	40	20	0	0	20
Total	**140**	**24**	**11**	**11**	**24**

** 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 50% 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 would include measures to restrict workers from parking in surrounding streets.*

12.5.38 To ensure a robust assessment, the assessment has been based on a combination of the peak hour of movements for construction and worker vehicle movements between 07:00–09:00 and 17:00-19:00. These have been combined and applied to the peak hour to take into account the highest number of movements generated by the site.

12.5.39 Assuming that all material would be transported by road, an average peak flow of 140 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 the 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, due to the site access not being on a strategic road, lane widths being maintained at a minimum of 3.25m during construction and construction traffic flows being between four and 20 two way HGV movements an hour.

12.5.42 It is assessed that there would be one potentially hazardous load to/from site per fortnight. This equates to a low adverse impact in relation to the number of hazardous loads anticipated to be generated by the site.

12.5.43 Local TRANSYT and LinSig models have been used to apply the construction traffic demands and local geometrical changes to the construction base case to determine the changes in the highway network operation due to the project (ie, comparison of base with the Phase 1 and Phase 2 development cases). The development case traffic flows (providing input to the TRANSYT and LinSig models) are shown on Vol 13 Figure 12.4.6 and Vol 13 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 in Phase 1 of construction for the junctions to the north end of Deptford Church Street (A2209) are presented in Vol 23 Table 12.5.3 and Vol 23 Table 12.5.4. Vol 23 Table 12.5.5 and Vol 23 Table 12.5.6 show a summary of the results for construction Phase 2 in the weekday AM and PM peak hours, respectively. Vol 23 Table 12.5.7 and Vol 23 Table 12.5.8 show the results for the junction of Deptford Church Street (A2209), Deptford Bridge (A2), Brookmill Road (A2210) and Deptford Broadway (A2) for both Phases 1 and 2 of construction in the AM and PM peak hours.

12.5.45 In construction Phase 1, the construction traffic generated would produce an increase in demand at all the modelled junctions and the Deptford Church Street (A2209) pedestrian crossing to the south of Coffey Street. In the AM peak hour, the maximum increase in delay of one second per vehicle over that in the construction base case would be experienced by vehicles using the Creek Road (A200) eastbound right and Deptford Church Street (A2209) north middle lane movements. This represents a negligible impact.

12.5.46 In the PM peak hour, the maximum increase to delay would be 30 seconds per vehicle at the left and right turn movement of Giffin Street. This represents a negligible impact.

12.5.47 The construction traffic and highway layout changes in Phase 2 would produce a change in vehicle movements and operation of the junctions. The overall performance of the modelled junctions and the Deptford Church Street (A2209) pedestrian crossing to the south of Coffey Street would deteriorate in the AM and PM peak hours.

12.5.48 The Phase 2 model indicates that the additional road network delay during the AM peak hour as a result of the additional construction traffic and the highway layout changes would be a maximum of one second on Creek Road (A200) and Deptford Church Street (AA209). This represents a negligible impact.

12.5.49 In the PM peak hour, the maximum increase to delay would be 30 seconds per vehicle at the left and right turn movement of Giffin Street. This represents a negligible impact.

12.5.50 At the junction of Deptford Broadway (A2) / Deptford Bridge (A2) / Deptford Church Street (A2209) / Brookmill Road there would be a maximum increase of approximately six seconds at the Deptford Broadway (A2) ahead nearside lane movement during the AM peak hour. During the PM peak hour there would be a maximum increase of approximately 49 seconds on the Deptford Broadway (A2) ahead and right movement. This represents a negligible impact.

Vol 23 Table 12.5.3 Transport – construction TRANSYT model outputs for junctions at north end of Deptford Church Street (A2209), Phase 1, AM peak hour

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Junction of Creek Road (A200) and Deptford Church Street (A2209)											
Creek Road (A200) - westbound	Left	49	31%	31%	0%	1	1	0	48	48	0
	Left (Buses)	10	31%	31%	0%	1	1	0	48	48	0
	Ahead (middle lane)	234	65%	63%	-2%	18	18	0	24	23	-1
	Ahead (offside lane)	738	65%	63%	-2%	18	18	0	24	23	-1
Creek Road (A200) - eastbound	Ahead (nearside lane)	203	21%	21%	0%	3	3	0	7	7	0
	Ahead (middle lane)	200	21%	21%	0%	3	3	0	7	7	0
	Right	395	40%	42%	+2%	8	8	0	26	27	+1
	Right (Buses)	26	40%	42%	+2%	8	8	0	26	27	+1
Deptford Church Street (A2209) - northbound	Left (nearside lane)	72	9%	9%	0%	0	0	0	3	3	0
	Left (middle lane)	372	25%	23%	-2%	1	1	0	3	4	+1
	Right	20	7%	11%	+4%	0	0	0	23	23	0

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
			PRC						Total delay (PCU hours)		
Overall junction performance			38%	43%	+5%				11.53	11.54	+0.01
Deptford Church Street (A2209) pedestrian crossing near Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead (nearside lane)	73	8%	8%	0%	0	0	0	10	10	0
	Ahead (offside lane)	383	44%	43%	-1%	3	2	-1	12	12	0
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	36	4%	4%	0%	0	0	0	16	16	0
	Ahead (offside lane)	445	51%	50%	-1%	4	4	0	16	15	-1
			PRC						Total delay (PCU hours)		
Overall junction performance			76%	80%	+4%				3.58	3.49	-0.09
Junction of Deptford Church Street (A2209) and Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead	383	20%	20%	0%	0	0	0	1	1	0
	Ahead / left	73	4%	4%	0%	0	0	0	1	1	0
Deptford Church Street (A2209) -	Ahead (nearside lane)	36	2%	2%	0%	0	0	0	1	1	0

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
southbound	Ahead (offside lane)	445	22%	23%	+1%	0	0	0	1	1	0
Coffey Street	Left	48	6%	8%	+2%	0	0	0	3	3	0
			PRC						Total delay (PCU hours)		
Overall junction performance			309%	291%	-18%				0.29	0.30	+0.01
Junction of Deptford Church Street (A2209) and Crossfield Street											
Deptford Church Street (A2209) - northbound	Ahead / left	73	4%	4%	0%	0	0	0	1	1	0
	Ahead	396	19%	20%	+1%	0	0	0	1	1	0
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	36	2%	2%	0%	0	0	0	1	1	0
	Ahead (offside lane)	445	22%	23%	+1%	0	0	0	1	1	0
Crossfield Street	Left	24	4%	N/A	N/A	0	0	N/A	3	3	N/A
			PRC						Total delay (PCU hours)		
Overall junction performance			309%	291%	-18%				0.28	0.28	0
Junction of Deptford Church Street (A2209) and Giffin Street											

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Deptford Church Street (A2209) - northbound	Ahead / left	397	48%	48%	0%	6	6	0	18	18	0
	Ahead	376	39%	40%	+1%	6	6	0	17	17	0
Deptford Church Street (A2209) – southbound	Ahead / right	445	47%	48%	+1%	1	1	0	4	4	0
	Ahead	36	4%	4%	0%	0	0	0	2	2	0
Giffin Street	Left / right	47	28%	28%	0%	1	1	0	48	48	0
			PRC						Total delay (PCU hours)		
Overall network performance			88%	88%	0%				4.85	4.90	+0.05

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. 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. 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. 12.3.22.

Vol 23 Table 12.5.4 Transport – construction TRANSYT model outputs for junctions at north end of Deptford Church Street (A2209), Phase 1, PM peak hour

Approach	Movement	Flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Junction of Creek Road (A200) and Deptford Church Street (A2209)											
Creek Road (A200) - westbound	Left	67	24%	25%	+1%	2	2	0	42	42	0
	Left (Buses)	10	24%	25%	+1%	2	2	0	42	42	0
	Ahead (middle lane)	162	51%	51%	0%	11	11	0	15	15	0
	Ahead (offside lane)	310	51%	51%	0%	11	11	0	15	15	0
Creek Road (A200) - eastbound	Ahead (nearside lane)	425	44%	44%	0%	9	9	0	10	10	0
	Ahead (middle lane)	427	44%	44%	0%	9	9	0	10	10	0
	Right	590	44%	44%	0%	13	13	0	23	23	0
	Right (Buses)	68	44%	44%	0%	13	13	0	23	23	0
Deptford Church Street (A2209) - northbound	Left (nearside lane)	50	4%	4%	0%	0	0	0	3	3	0
	Left (middle lane)	521	23%	23%	0%	1	1	0	3	3	0
	Right	100	31%	33%	+2%	2	2	0	19	19	0
			PRC						Total delay (PCU hours)		
Overall junction performance			76%	76%	0%				13.04	13.19	+0.15

Approach	Movement	Flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Deptford Church Street (A2209) pedestrian crossing near Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead (nearside lane)	49	3%	3%	0%	0	0	0	1	1	0
	Ahead (offside lane)	594	36%	37%	+1%	0	0	0	2	2	0
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	78	5%	5%	0%	0	0	0	1	1	0
	Ahead (offside lane)	657	40%	41%	+1%	1	1	0	2	2	0
			PRC						**Total delay (PCU hours)**		
Overall junction performance			125%	120%	-5%				0.72	0.73	+0.01
Junction of Deptford Church Street (A2209) and Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead	594	30%	31%	+1%	7	7	0	1	1	0
	Ahead / left	49	2%	2%	0%	0	0	0	1	1	0
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	78	4%	4%	0%	0	0	0	1	1	0
	Ahead (offside lane)	657	33%	33%	0%	0	0	0	2	2	0
Coffey Street	Left	50	7%	9%	+2%	0	0	0	3	3	0
			PRC						**Total delay (PCU hours)**		

Approach	Movement	Flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Overall junction performance			173%	173%	0%				0.59	0.61	+0.02
Junction of Deptford Church Street (A2209) and Crossfield Street											
Deptford Church Street (A2209) - northbound	Ahead / left	49	3%	3%	0%	0	0	0	1	1	0
	Ahead	584	29%	30%	+1%	12	12	0	4	4	0
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	78	4%	4%	0%	0	0	0	1	1	0
	Ahead (offside lane)	657	33%	33%	0%	0	0	0	1	1	0
Crossfield Street	Left	10	2%	2%	0%	0	0	0	3	3	0
			PRC						**Total delay (PCU hours)**		
Overall junction performance			173%	173%	0%				0.86	0.88	+0.02
Junction of Deptford Church Street (A2209) and Giffin Street											
Deptford Church Street (A2209) - northbound	Ahead / left	311	50%	50%	0%	7	7	0	30	30	0
	Ahead	328	46%	47%	+1%	7	7	0	29	29	0

Approach	Movement	Flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Deptford Church Street (A2209) - southbound	Ahead / right	657	94%	95%	+1%	11	12	+1	47	51	+4
	Ahead	78	11%	11%	0%	1	1	0	17	17	0
Giffin Street	Left / right	487	94%	99%	+5%	18	23	+5	78	108	+30
			PRC						Total delay (PCU hours)		
Overall junction performance			-4%	-10%	-6%				24.05	29.52	+5.47

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. 12.3.22.

Vol 23 Table 12.5.5 Transport – construction TRANSYT model outputs for junctions at north end of Deptford Church Street (A2209), Phase 2, AM peak hour

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Junction of Creek Road (A200) and Deptford Church Street (A2209)											
Creek Road (A200) - westbound	Left	50	31%	32%	+1%	1	1	0	48	48	0
	Left (Buses)	10	31%	32%	+1%	1	1	0	48	48	0
	Ahead (middle lane)	236	65%	68%	+3%	18	19	+1	24	25	+1
	Ahead (offside lane)	738	65%	68%	+3%	18	19	+1	24	25	+1
Creek Road (A200) - eastbound	Ahead (nearside lane)	203	21%	21%	0%	3	3	0	7	7	0
	Ahead (middle lane)	200	21%	21%	0%	3	3	.0	7	7	0
	Right	395	40%	38%	+2%	8	8	0	26	25	+1
	Right (Buses)	26	40%	38%	+2%	8	8	0	26	25	+1
Deptford Church Street (A2209) - northbound	Left (nearside lane)	73	9%	9%	0%	0	0	0	3	2	-1
	Left (middle lane)	382	25%	23%	+2%	1	0	-1	3	1	-2
	Right	20	7%	11%	+4%	0	0	0	23	24	+1

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
			PRC						Total delay (PCU hours)		
Overall junction performance			38%	32%	-6%				11.53	0.02	+7.97
Deptford Church Street (A2209) pedestrian crossing near Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead (nearside lane)	N/A	8%	N/A	N/A	0	N/A	N/A	10	N/A	N/A
	Ahead (offside lane)	476	44%	4%	-40%	3	0	-3	12	2	-10
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	36	4%	4%	0%	0	0	0	16	15	-1
	Ahead (offside lane)	395	51%	46%	-5%	4	3	-1	16	15	-1
			PRC						Total delay (PCU hours)		
Overall junction performance			76%	64%	-12%				3.58	3.91	+0.33
Junction of Deptford Church Street (A2209) and Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead	N/A	20%	N/A	N/A	0	N/A	N/A	1	N/A	N/A
	Ahead / left*	404	4%	21%	+17%	0	0	0	1	1	0
Deptford Church Street (A2209) -	Ahead (nearside lane)	N/A	2%	N/A	N/A	0	N/A	N/A	1	N/A	N/A

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
southbound	Ahead (offside lane)	481	22%	24%	+2%	0	0	0	1	1	0
Coffey Street	Left	72	6%	11%	+5%	0	0	0	3	3	0
			PRC						Total delay (PCU hours)		
Overall junction performance			309%	275%	-34%				0.29	0.31	+0.02
Junction of Deptford Church Street (A2209) and Crossfield Street											
Deptford Church Street (A2209) - northbound	Ahead / left*	469	4%	24%	+20%	0	4	+4	1	1	0
	Ahead**	N/A	19%	N/A	N/A	0	N/A	N/A	1	N/A	N/A
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	N/A	2%	N/A	N/A	0	N/A	N/A	1	N/A	N/A
	Ahead (offside lane)	481	22%	24%	+2%	0	5	+5	1	1	0
Crossfield Street	Left	N/A	4%	N/A	N/A	0	N/A	N/A	3	N/A	N/A
			PRC						Total delay (PCU hours)		
Overall junction performance			309%	275%	-34%				0.28	0.13	-0.15
Junction of Deptford Church Street (A2209) and Giffin Street											

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Deptford Church Street (A2209) - northbound	Ahead / left	397	48%	48%	0%	6	6	0	18	18	0
	Ahead	376	39%	40%	+1%	6	6	0	17	17	0
Deptford Church Street (A2209) – southbound	Ahead / right	445	47%	48%	+1%	1	1	0	4	4	0
	Ahead	36	4%	4%	0%	0	0	0	2	3	+1
Giffin Street	Left / right	47	28%	28%	0%	1	1	0	48	48	0
			PRC						Total delay (PCU hours)		
Overall network performance			88%	88%	0%				4.85	4.91	+0.06

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. 12.3.22.

** In the construction base case, it is ahead and left movement, in the construction development case, it is ahead only.*

*** In the construction base case, it is ahead only, in the construction development case, it is left only.*

Vol 23 Table 12.5.6 Transport – construction TRANSYT model outputs for junctions at north end of Deptford Church Street (A2209), Phase 2, PM peak hour

Approach	Movement	Flow	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (vehicles)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Junction of Creek Road (A200) and Deptford Church Street (A2209)											
Creek Road (A200) - westbound	Left	162	24%	56%	+32%	2	12	+10	42	50	+8
	Left (Buses)	10	24%	33%	+9%	2	2	0	42	50	+8
	Ahead (middle lane)	162	51%	56%	+5%	11	12	+1	36	38	+2
	Ahead (offside lane)	307	51%	56%	+5%	11	12	+1	36	38	+2
Creek Road (A200) - eastbound	Ahead (nearside lane)	427	44%	41%	-3%	9	7	-2	10	8	-2
	Ahead (middle lane)	425	44%	41%	-3%	9	7	-2	10	8	-2
	Right	590	44%	38%	-6%	13	12	-1	23	6	-17
	Right (Buses)	68	44%	38%	-6%	13	12	-1	23	6	-17
Deptford Church Street (A2209) - northbound	Left (nearside lane)	50	4%	4%	0%	0	0	0	3	2	-1
	Left (middle lane)	522	23%	22%	-1%	1	0	-1	3	2	-1
	Right	101	31%	45%	+14%	2	3	+1	19	31	+12

Approach	Movement	Flow	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (vehicles)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
			PRC						Total delay (PCU hours)		
Overall junction performance			76%	61%	-15%				13.04	13.17	+0.13
Deptford Church Street (A2209) pedestrian crossing near Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead (nearside lane)	N/A	3%	N/A	N/A	0	N/A	N/A	1	N/A	N/A
	Ahead (offside lane)	671	36%	41%	+5%	0	1	+1	2	2	0
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	78	5%	5%	0%	0	0	0	1	2	+1
	Ahead (offside lane)	657	40%	41%	+1%	1	9	+8	2	2	0
			PRC						Total delay (PCU hours)		
Overall junction performance			125%	120%	-5%				0.72	0.96	+0.24
Junction of Deptford Church Street (A2209) and Coffey Street											
Deptford Church Street (A2209) - northbound	Ahead	N/A	30%	N/A	N/A	7	N/A	N/A	1	N/A	N/A
	Ahead / left*	621	2%	32%	+30%	0	0	0	1	1	0

Approach	Movement	Flow	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (vehicles)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	N/A	4%	N/A	N/A	0	N/A	N/A	1	N/A	N/A
	Ahead (offside lane)	735	33%	37%	+4%	0	11	+11	2	2	0
Coffey Street	Left	50	7%	9%	+2%	0	0	0	3	3	0
			PRC						Total delay (PCU hours)		
Overall junction performance			173%	143%	-30%				0.59	0.62	+0.03
Junction of Deptford Church Street (A2209) and Crossfield Street											
Deptford Church Street (A2209) - northbound	Ahead / left*	633	3%	32%	+29%	0	13	+13	1	2	+1
	Ahead**	N/A	29%	N/A	N/A	12	N/A	N/A	4	N/A	N/A
Deptford Church Street (A2209) - southbound	Ahead (nearside lane)	N/A	4%	N/A	N/A	0	N/A	N/A	1	N/A	N/A
	Ahead (offside lane)	735	33%	37%	+4%	0	11	+11	1	2	+1
Crossfield Street	Left	N/A	2%	N/A	N/A	0	N/A	N/A	3	N/A	N/A

Approach	Movement	Flow	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (vehicles)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
			PRC						Total delay (PCU hours)		
Overall junction performance			173%	143%	-30%				0.86	0.76	+0.10
Junction of Deptford Church Street (A2209) and Giffin Street											
Deptford Church Street (A2209) - northbound	Ahead / left	311	50%	50%	0%	7	7	0	30	30	0
	Ahead	328	46%	47%	+1%	7	7	0	29	29	0
Deptford Church Street (A2209) - southbound	Ahead / right	657	94%	95%	+1%	11	15	+4	47	56	+9
	Ahead	78	11%	11%	0%	1	1	0	17	21	+4
Giffin Street	Left / right	487	94%	99%	+5%	18	23	+5	78	108	+30
			PRC						Total delay (PCU hours)		
Overall junction performance			-4%	-10%	-6%				24.05	30.52	+6.47

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. 12.3.22.
** In the construction base case, it is ahead and left movement, in the construction development case, it is ahead only.*
*** In the construction base case, it is ahead only, in the construction development case, it is left only.*

Vol 23 Table 12.5.7 Transport – LinSig model outputs for Deptford Broadway (A2) / Deptford Bridge (A2) / Deptford Church Street (A2209) / Brookmill Road (A2210), Phases 1 and 2, AM peak hour

Approach	Movement	Flow	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (vehicles)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Deptford Church Street (A2209) - southbound	Left	276	19%	19%	0%	1	1	0	7	7	0
	Ahead / right	330	64%	64%	0%	7	7	0	35	35	0
Deptford Bridge (A2)	Ahead / left	610	80%	78%	-2%	13	12	-1	32	31	-1
	Ahead / right	859	81%	84%	+3%	10	11	+1	32	33	+1
Brookmill Road (A2210)	Ahead / left / right	493	82%	82%	0%	12	12	0	41	41	0
Deptford Broadway (A2)	Ahead (nearside lane)	243	67%	74%	+7%	6	6	0	45	51	+6
	Ahead (middle lane)	280	71%	76%	+5%	7	7	0	46	51	+5
	Ahead Right	356	76%	80%	+4%	7	7	0	47	52	+5
	Left	127	23%	23%	0%	0	1	+1	4	4	0
			PRC						Total delay (PCU hours)		
Overall junction performance			10%	7.2%	-2.8%				33.50	35.34	+1.84

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. 12.3.22.

Vol 23 Table 12.5.8 Transport – LinSig model outputs for Deptford Broadway (A2) / Deptford Bridge (A2) / Deptford Church Street (A2209) / Brookmill Road (A2210), Phases 1 and 2, PM peak hour

Approach	Movement	Flow	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (vehicles)			Delay per PCU (seconds)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Deptford Church Street (A2209) - southbound	Left	386	32%	33%	+1%	3	3	0	12	14	+2
	Ahead / right	398	72%	79%	+7%	10	11	+1	40	47	+7
Deptford Bridge (A2)	Ahead / left	739	81%	87%	+6%	10	13	+3	28	30	+2
	Ahead / right	400	81%	82%	+1%	9	9	0	39	48	+9
Brookmill Road (A2210)	Ahead / left / right	462	81%	88%	+7%	13	14	+1	44	57	+13
Deptford Broadway (A2)	Ahead (nearside lane)	455	64%	73%	+9%	8	11	+3	37	37	0
	Ahead (middle lane)	522	67%	75%	+8%	10	13	+3	37	37	0
	Ahead / right	142	77%	83%	+6%	7	6	-1	45	94	+49
	Left	130	23%	22%	-1%	0	0	0	4	4	0
			PRC						Total Delay (PCU Hours)		
Overall junction performance			11%	2%	-9%				35.33	39.28	+3.95

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. 12.3.22.

Significance of effects

12.5.51 The significance of the effects has been determined based on the transport impacts described above, considered in the context of the sensitivity of the receptors identified in Vol 23 Table 12.4.3 and Vol 23 Table 12.4.4.

12.5.52 Vol 23 Table 12.5.9 sets out the effects on each receptor in the vicinity of the site.

Vol 23 Table 12.5.9 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 Coffey Street or Crossfield Street, Deptford Church Street for access and as a through route	Major adverse effect on pedestrians. Minor adverse effect on cyclists	**Pedestrians:** • High sensitivity • Medium adverse impact on pedestrian delay • High adverse impact on pedestrian amenity and accidents and safety • Due to medium and high adverse impacts, equates to major adverse effect. **Cyclists:** • High sensitivity • Negligible impact of on cycle delay • Low adverse impact on accidents and safety • Due to negligible and low adverse magnitude, 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 Minor adverse effect on parking users	**Highway users:** • Medium sensitivity • Negligible impact on road network delay • Low adverse impact

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		on accidents and safety and from hazardous loads • Due to majority low adverse impact magnitude, equates to minor adverse effect. **Parking users:** • Medium sensitivity • Low adverse impact on vehicle parking • Due to low adverse impact magnitude, equates to minor adverse effect.
Emergency vehicles using the road network in the local area	Minor adverse effect	• High sensitivity • Negligible impact on road network delay • Low adverse impact on accidents and safety and from hazardous loads • Due to majority low adverse impact magnitude, equates to minor adverse effect.
Service vehicles using loading bay on Creek Road (A200)	Negligible effect	• Low sensitivity • Negligible impact on loading bay • Equates to negligible effect
Bus passengers using services along Deptford Church Street (A2209)	Negligible effect	• Medium sensitivity • Negligible impact on road network delay and public transport patronage • Due to negligible

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		impact magnitude, equates to negligible effect.
Public transport users using rail within the area	Negligible effect	• Low sensitivity • Negligible impact on public transport patronage • Due to negligible impact, equates to negligible effect.
Business and workplace occupiers at Crossfield Street Residents and users of Giffin Street Regeneration Area Residential area Residents and users of Creekside Village East development	Major adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Minor adverse effect on parking users	**Pedestrians:** • Medium sensitivity • Medium adverse impact on pedestrian delay • High adverse impact on pedestrian amenity and accidents and safety • Due to medium and high adverse impacts, equates to major adverse effect. **Cyclists:** • Medium sensitivity • Negligible impact of on cycle delay • Low adverse impact on accidents and safety • Due to negligible and low adverse magnitude, equates to minor adverse effect. **Highway users:** • Medium sensitivity • Negligible impact on road network delay

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		• Low adverse impact on accidents and safety and from hazardous loads • Due to majority low adverse impact magnitude, equates to minor effect. **Parking users:** • Medium sensitivity • Low adverse impact on vehicle parking • Due to low adverse impact magnitude, equates to minor adverse effect.
Pupils, parents and staff at St Joseph's Roman Catholic Primary School Users of St Paul's Church Users of the playground	Major adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Minor adverse effect on parking users	**Pedestrians:** • High sensitivity • Medium adverse impact on pedestrian delay • High adverse impact on pedestrian amenity and accidents and safety • Due to medium and high adverse impacts, equates to major adverse effect. **Cyclists:** • High sensitivity • Negligible impact of on cycle delay • Low adverse impact on accidents and safety • Due to negligible and low adverse magnitude, equates to minor adverse effect.

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		Highway users: • High sensitivity • Negligible impact on road network delay • Low adverse impact on accidents and safety and from hazardous loads • Due to majority low adverse impact magnitude, equates to minor adverse effect. **Parking users:** • High sensitivity • Low adverse impact on vehicle parking Due to low adverse impact magnitude, equates to minor adverse effect.
Users of Wavelengths Leisure Centre	Moderate adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Minor adverse effect on parking users	**Pedestrians:** • Low sensitivity • Medium adverse impact on pedestrian delay • High adverse impact on pedestrian amenity and accidents and safety • Due to sensitivity of receptor, equates to moderate adverse effect. **Cyclists:** • Low sensitivity • Negligible impact of on cycle delay • Low adverse impact on accidents and

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		safety • Due to negligible and low adverse magnitude, equates to minor adverse effect. **Highway users:** • Low sensitivity • Negligible impact on road network delay • Low adverse impact on accidents and safety and from hazardous loads • Due to majority low adverse impact magnitude, equates to minor adverse effect. **Parking users:** • Low sensitivity • Low adverse impact on vehicle parking • Due to low adverse impact magnitude, equates to minor adverse effect.

Sensitivity test for programme delay

12.5.53 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.

12.5.54 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 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 and rail 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 project 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 Deptford Church Street 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 site development schedule (see Vol 23 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 (Giffin Street Regeneration Area, Creekside Village East, Convoys Wharf and the Heathside and Lethbridge Estate) 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 the Year 1 of operation at the Deptford Church Street 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 and larger cranes and associated support vehicles required for access to the shaft and tunnel approximately 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 base case highway network as outlined in Section 12.2. This 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 on-street parking and on the highway layout and operation when maintenance visits are made to the site.

Parking

12.6.5 When large vehicles are required to service the site, all 14 parking bays would have to be temporarily restricted on Coffey Street, and unmarked kerbside parking capacity temporarily prohibited along Crossfield Street, to ensure the vehicles have sufficient space to manoeuvre into and out of the site. This temporary restriction would be on an infrequent basis and is anticipated to occur a maximum of approximately once every ten years.

12.6.6 Based on the impact magnitude criteria outlined in Vol 2 Section 12, the temporary restriction of parking bays would result in a low adverse impact on parking within the local area.

12.6.7 However, taking into consideration the infrequent and temporary nature of the arrival of vehicles at Deptford Church Street site which would require parking restriction, and the sensitivity of the receptor, it is anticipated that there would be a **negligible** effect on parking.

Highway layout and operation

12.6.8 As shown in the permanent highway layout plan (see separate volume of figures – Section 1), the site would be accessed from Deptford Church Street (A2209) via Crossfield Street and exited onto Coffey Street during the operational phase.

12.6.9 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 flatbed vehicles to access the site.

12.6.10 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 a 11.36m mobile crane, 10m rigid vehicle and a 10.7m articulated vehicle. The permanent highway layout vehicle swept path analysis plan (see Deptford Church Street *Transport Assessment* figures) demonstrates that maintenance vehicles would be able to safely enter and leave the site.

12.6.11 As described above, as a result of the large turning circles of the cranes, parking bays would have to be restricted on Coffey Street to ensure the vehicles have sufficient space to manoeuvre out of the site. This would occur every ten years.

12.6.12 When larger vehicles are required to service the site, there may also 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.

12.6.13 In accordance with the criteria outlined in Vol 2 Section 12, during the routine inspections of the operational site, it is anticipated that there would be a negligible impact on road network delay.

12.6.14 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

12.6.15 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 As indicated in the site development schedule (see Vol 23 Appendix N), all of the other developments identified within 1km of the Deptford Church Street site would be complete and operational by Site Year 1 of construction with the exception of the Heathside and Lethbridge Estate redevelopment. 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 (Greater London Authority, 2011)[6]. As a result the assessment inherently takes into account a level of future growth and development across London.

12.7.2 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

12.7.3 As detailed in para. 12.3.17, the Heathside and Lethbridge Estate development would be under construction in Year 1 of operation at the Greenwich Pumping Station site. This suggests that there are cumulative effects to assess for the operational assessment. However, given the distance of the development from the site, cumulative effects would not be significant.

12.7.4 Therefore the effects on transport would remain as described in Section 12.6. 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.

Construction effects

12.8.2 During construction it is envisaged that the embedded measures set out in Section 12.2, including the *CoCP* and *Draft Project Framework Travel Plan*, would minimise the effects resulting from construction works at the Deptford Church Street site.

12.8.3 These are the most appropriate measures for this site and it is not possible to mitigate all significant effects.

Operation effects

12.8.4 No mitigation is required during the operational phase.

12.9 Residual effects assessment

Construction effects

12.9.1 As no mitigation measures are proposed, the residual operational 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 12.6. All residual effects are presented in Section 12.10.

12.10 Assessment summary

Vol 23 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 Coffey Street, Crossfield Street or Deptford Church Street for access and as a through route.	• Movement of large construction vehicles • Pedestrian diversion routes • Relocation of pedestrian crossing at Coffey Street and Deptford Church Street (A2209) junction	Major adverse effect on pedestrians Minor adverse effect on cyclists	None.	Major adverse effect on pedestrians. Minor adverse effect on cyclists
Private vehicle users in the area using the local highways or on-street parking.	• Movement of large construction vehicles • Highway layout changes including highway capacity modifications • Delay to journey time	Minor adverse effect on highway users Minor adverse effect on parking users	None	Minor adverse effect on highway users Minor adverse effect on parking users
Emergency vehicles using the road network within the local area.	• Movement of large construction vehicles • Highway layout changes including highway capacity modifications	Minor adverse effect	None	Minor adverse effect

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
	• Delay to journey time			
Service vehicles using loading bay on Creek Road (A200)	• No effect on loading bay	Negligible effect	None	Negligible effect
Bus passengers using services along Deptford Church Street (A2209)	• Bus stop relocations • Delay to journey time • Some additional patronage from construction workers	Negligible effect	None	Negligible effect
Public transport users using rail within the area	• Some additional patronage from construction workers	Negligible effect	None	Negligible effect
Business and workplace occupiers at Crossfield Street Users of St Paul's Church Pupils, parents and staff St Joseph's Roman Catholic Primary School Residents and users of Giffin Street Regeneration Area Residents and users of Creekside Village East development	• Movement of large construction vehicles • Pedestrian diversion routes • Pedestrian crossing relocation • Bus stop relocations • Highway layout changes including highway capacity changes • Delay to journey time	Major adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Minor adverse effect on parking users	None	Major adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Minor adverse effect on parking users

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential area Users of playground				
Users of Wavelengths Leisure Centre	• Movement of large construction vehicles • Pedestrian diversion routes • Pedestrian crossing relocation • Bus stop relocations • Highway layout changes including highway capacity changes • Delay to journey time	Moderate adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Minor adverse effect on parking users	None	Moderate adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Minor adverse effect on parking users

Vol 23 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 maintenance trips resulting in some temporary, short-term road network delay.	Negligible effect	None	Negligible effect
Emergency vehicles accessing the commercial and residential units within the local 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] TfL, *Travel Planning for new development in London,* Transport for London (2011).

[3] Transport for London, *Assessment Tool for Travel Plan Building Testing and Evaluation (ATTrBuTE)*, 2011. http://www.attrbute.org.uk/

[4] Greater London Authority, *London Plan*, July 2011.

[5] Transport for London, *Transport Assessment Best Practice Guidance*, April 2010.

[6] Greater London Authority 2011. See citation above.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 13: Water resources - groundwater

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

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Thames Tideway Tunnel

Environmental Statement

Volume 23: Deptford Church Street 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 the Deptford Church Street site (including the Deptford Church Street highway work site).

13.1.2 The proposed development has the potential to affect groundwater due to:

a. dewatering of aquifer units

b. use of grout/ground treatment to control ingress of water

c. creation of pathways for pollution

d. obstruction to groundwater flows

e. seepages into and out of the combined sewer outflow (CSO) drop shaft during operations.

13.1.3 This groundwater assessment at this site should be read in conjunction with the supporting Vol 23 Appendix K (K.1 – K.9) and the land quality assessment (Section 8 of this volume).

13.1.4 The site is underlain by a secondary aquifer[i] (the upper aquifer) and a principal aquifer [ii] (the lower aquifer), which are likely to be in hydraulic continuity where the London Clay Formation and Lambeth Group are absent. Any dewatering during the construction of the CSO shaft of either the upper or lower aquifer would be internal to diaphragm walls[iii] or piled walls[iv]. Groundwater flow either through or beneath these types of walls would be minimised by use of ground treatment[v]. The Deptford Church

[i] 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).

[ii] Principal aquifer – a geological stratum that exhibits high inter-granular and /or fracture permeability (was previously referred to as a major aquifer)

[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] Sheet or secant pile wall - a sub-surface barrier installed to support excavation and which amongst other things helps to control inflows of shallow groundwater, typically formed of intersecting or overlapping shafts of concrete.

[v] Ground treatment - the controlled alteration of the state, nature or mass behaviour of ground materials in order to achieve an intended satisfactory response to existing or projected environmental and engineering plans.

Street site lies within a Source Protection Zone (SPZ) 2[vi] of a Chalk public water supply source located within a 1km of the site.

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 Table 13.3.1).

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 (Vol 23 Deptford Church Street Figures).

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 Deptford Church Street site, relevant to the consideration of groundwater, would include:

a. CSO drop shaft of approximately 17m internal diameter (ID) and approximately 48m deep (based on 57.81mATD[vii] from an assumed ground level of 105.75mATD), excluding an approximately 3m thick base slab once constructed, constructed in the centre of the Deptford Church Street site. No tunnelling excavation works are required as the Deptford Church Street 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 Earl Pumping Station site.

b. An interception chamber for the existing Deptford Storm Relief sewer.

c. A connection culvert from the interception chamber to the CSO drop shaft.

[vi] Source Protection Zones – are defined around all major public water supply abstractions sources and large licensed private abstractions in order to safeguard groundwater resources from potentially polluting activities. SPZ are split into three zones; an SPZ 1 defined as a 50 day travel time to a source, an SPZ 2 defined as a 400 day travel time to a source and an SPZ 3 represents the total catchment zone of a source.

[vii] 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

13.2.3 The proposed methods of construction for these elements of the Deptford Church Street site are described in Section 3 of this volume and summarised in Vol 23 Table 13.2.1. Approximate duration of construction and depths are also contained in Vol 23 Table 13.2.1.

Vol 23 Table 13.2.1 Groundwater – methods of construction

Design element	Method of construction	Construction periods (years)*	Construction depth(mbgl)**
CSO drop shaft	Diaphragm walls with internal dewatering	1-2	Deep (around 48)
Interception chamber and connection culvert	Secant or sheet piling with local dewatering and ground treatment	1	Deep (around 11)

** The site would be used for construction purposes for up to three and a half years*
*** In terms of construction depth - shallow (means <10m) and 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 adverse effects on groundwater are minimised are as follows:

a. Measures include providing bunded stores for fuel/oils held on site and the settlement of dewatering from excavations to prevent silty water from entering watercourses, surface water drains and onto roads as per Environment Agency (EA) guidelines (EA, 2011)[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 by monitoring water quality, would be applied to licensed abstractions thought to be at risk.

c. Monitoring arrangements for dewatering permits 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.

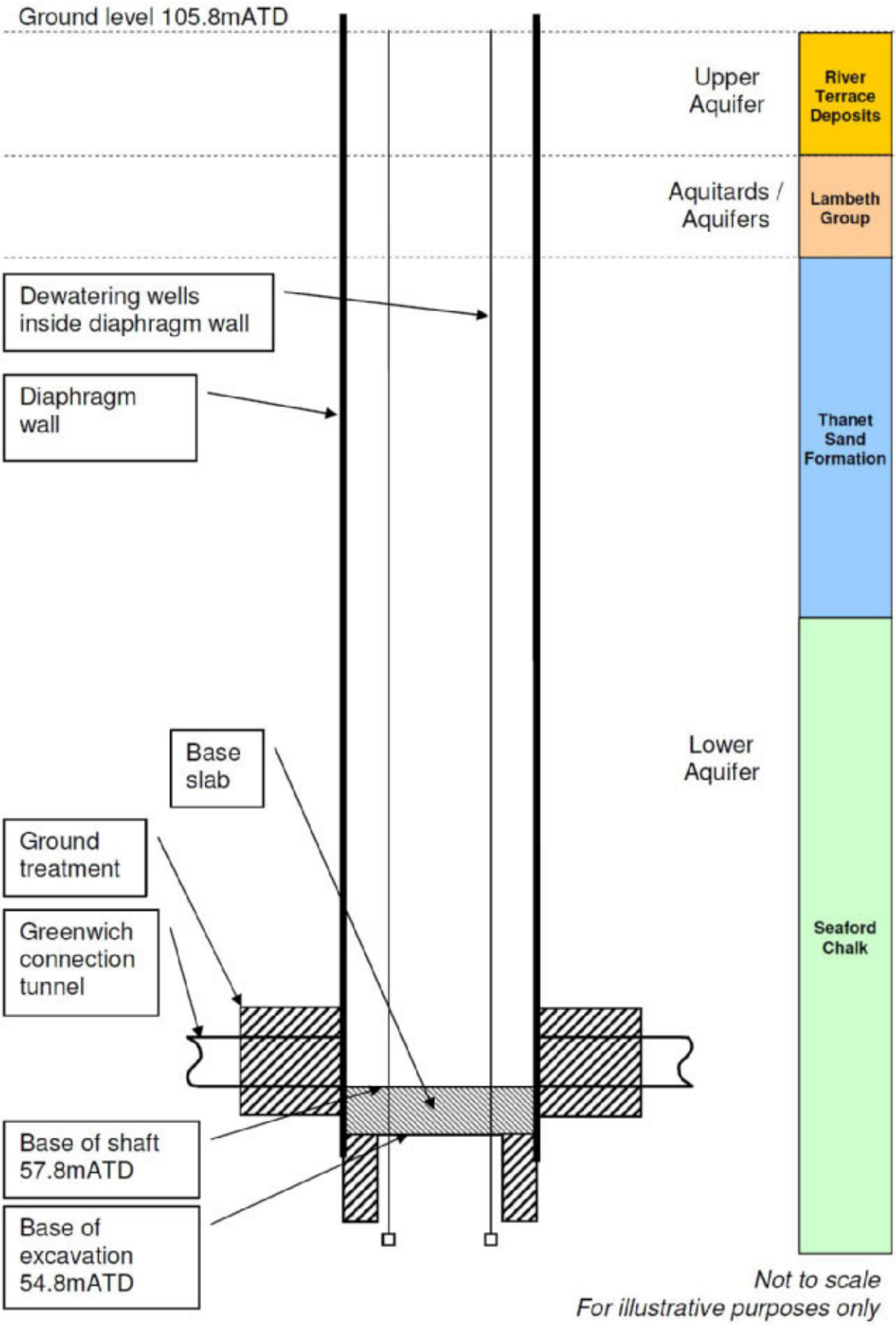
e. At the end of construction where temporary support does not form part of the operational structure it would be removed, piped through or cut down to avoid the build up of groundwater on the upstream side of underground structures.

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 means it would extend down into the Seaford Chalk (and approximately 39m into the lower aquifer) (see Vol 23 Table 13.2.1 and Vol 23 Appendix K.1), which is expected to contain substantial quantities of groundwater. The CSO drop shaft would be constructed using diaphragm walling techniques (see Vol 23 Plate 13.2.1) installed to a depth suitable to reduce the flow of water into the drop shaft, below the base of the CSO drop shaft. This method would reduce the amount of pumping required from within the diaphragm wall. There would be no pumping external to the diaphragm wall (internal dewatering would be undertaken). This should ensure any movement of known groundwater 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 TBM into the Greenwich connection tunnel (approximately 6 months).

Vol 23 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 the Deptford Church Street site is less than 200m^3/d. This relatively small volume is due to the method proposed to construct the CSO drop shaft. The pumped groundwater would be extracted and following any necessary treatment and subject to EA approval, discharged directly to an appropriate sewer on site.

13.2.8 The depth of the interception chamber and connection culvert means that they would extend into either the Lambeth Group or the Thanet Sand (see Vol 23 Table 13.2.1 and Vol 23 Appendix K.1). All of these formations may be water-bearing to a greater or lesser degree. The sub-surface structures would be constructed using secant or sheet piling, local dewatering and ground treatment would be required within the water-bearing horizons. Wells would be drilled internal to the secant or sheet piling and pumped to lower the pressure. Groundwater would be extracted and following any necessary treatment and subject to EA approval, discharged directly into an appropriate existing sewer. The duration of pumping would be determined by ground conditions but could be for the duration of the interception works.

13.2.9 Ground treatment, including fissure grouting[viii], is anticipated to be required for construction in the Seaford Chalk (lower aquifer) for CSO drop shaft construction and to facilitate TBM break in / out. It is also anticipated that some grouting would be required within the water bearing horizons for the interception chamber works where the excavation spans the existing sewer.

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*.

13.3.2 The *Scoping Report* was prepared before Deptford Church Street site had been identified as a preferred site. The scope for the assessment of groundwater for this site has therefore drawn on the scoping responses from the London Borough (LB) of Lewisham (in relation to other sites) and is based on professional judgement as well as experience of similar sites.

[viii] 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.

13.3.3 The consultation process has not highlighted any new issues relating to groundwater at the Deptford Church Street.

Baseline

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

13.3.5 The baseline describes receptors within a 1km radius of the CSO sites during both construction and operation.

13.3.6 The effects on groundwater may extend beyond a kilometre depending on the hydrogeological setting and the method of construction taking place where this is anticipated. These effects are considered of wider regional significance and are assessed in the project-wide assessment (Vol 3).

Construction

13.3.7 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.

13.3.8 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 the Deptford Church Street site. The baseline is not anticipated to change substantially between 2011 and Site Year 1 of construction (2016) and so baseline data from 2011 have formed the basis (base case) for the construction assessment.

13.3.9 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.

13.3.10 The developments considered as part of the base case and those included in the cumulative effects assessment are presented in Vol 23 Table 13.3.1. The developments relevant to groundwater are those which would contain basements.

Vol 23 Table 13.3.1 Groundwater – construction base case and cumulative assessment developments

Development	Component or receptor relevant to groundwater	Construction base case	Cumulative effect assessment
Site of old Seagar Distillery and Norfolk House	Basement*	✓	✗
Greenwich Industrial Estate - land bounded by Norman Road, Greenwich High Road and Waller Way, Greenwich	Basement*	✓	✗

Development	Component or receptor relevant to groundwater	Construction base case	Cumulative effect assessment
Land at Stockwell Street and John Humphries House	Basement*	✓	×
Heathside and Lethbridge Estate	Basement*	✓	×
Greenwich Reach East	Basement*	✓	×
Bardsley Lane - Land at Creek Road/ Bardsley Lane	Basement*	✓	×
Creekside Village East, Copperas Street	Basement*	×	✓
Convoys Wharf	Basement*	×	✓

** Relevant to the upper aquifer*
Symbols ✓ applies × does not apply

13.3.11 Section 13.5 details the likely significant effects arising from the construction at the Deptford Church Street site. Other nearby Thames Tideway Tunnel project sites which could give rise to additional effects on groundwater resources are Kirtling Street and Blackfriars Bridge Foreshore within the assessment area for this site. 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 Deptford Church Street, following the methodology set out in Vol 2 Section 13.

Operation

13.3.12 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.

13.3.13 The assessment year applied to the operational assessment is Year 1 of operation. The baseline is not anticipated to vary significantly by the start of the operational phase in 2023; and therefore baseline data from 2011 have formed the basis for the operational assessment. In addition, information on proposed development schemes likely to have been completed before commencement of the operation at this site has formed the operational base case.

13.3.14 The developments considered as part of the operational base case are included in Vol 23 Table 13.3.2. No developments have been identified which would be considered as part of the cumulative effects assessment. The developments relevant to groundwater are those which would contain basements.

Vol 23 Table 13.3.2 Groundwater – operational base case and cumulative assessment developments

Development	Component or receptor relevant to groundwater	Operational base case	Cumulative effect assessment
Site of old Seagar Distillery and Norfolk House	Basement*	✓	✗
Greenwich Industrial Estate - land bounded by Norman Road, Greenwich High Road and Waller Way, Greenwich	Basement*	✓	✗
Land at Stockwell Street and John Humphries House	Basement*	✓	✗
Heathside and Lethbridge Estate	Basement*	✓	✗
Greenwich Reach East	Basement*	✓	✗
Bardsley Lane - Land at Creek Road/ Bardsley Lane	Basement*	✓	✗
Creekside Village East, Copperas Street	Basement*	✓	✗
Convoys Wharf	Basement*	✓	✗

** Relevant to the upper aquifer*
Symbols ✓ applies ✗ does not apply

13.3.15 Section 13.6 details the likely significant effects arising from the operation at the Deptford Church Street 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 the Deptford Church Street site during the operational phase and so no other Thames Tideway Tunnel project sites are considered in this assessment.

Assumptions and limitations

Assumptions

13.3.16 The construction assumptions relevant to this site are presented in Section 13.2.

13.3.17 The assessment 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 (see Vol 2 Section 13).

The hydraulic properties for the Chalk obtained from this model include an average transmissivity value of approximately 2,000m^2/d (Environment Agency and ESI, 2010)[3] and a storativity[ix] value of approximately 1 x10^{-4} at the Deptford Church Street site (see Vol 2 Section 13).

13.3.18 The amount of pumping required from within the diaphragm wall at the Deptford Church Street site is assumed to be less than 200m^3/d.

13.3.19 The assessment of obstruction effects in Sections 13.5 and 13.6 is based on estimated hydraulic gradient[x] of 0.004 in the upper aquifer across the site.

13.3.20 The upper aquifer is assumed to be in hydraulic continuity with the overlying layers, Alluvium and Made Ground.

13.3.21 The regional groundwater flow direction in the Chalk is based on the EA groundwater contour map (EA, 2011)[4] and this indicates flow towards the northwest. However the site lies within the capture zone for a major public water supply source located to the south, which is likely to reverse the regional groundwater flow direction here.

13.3.22 In the absence of active monitoring boreholes on site, the hydrogeological conditions encountered at the nearest off site boreholes are assumed to be representative of site conditions at the Deptford Church Street site.

13.3.23 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).

13.3.24 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

13.3.25 For the purposes of this assessment, deep means greater than 10m below ground level (bgl) and shallow means less than 10m bgl.

Limitations

13.3.26 No site-specific pumping tests have yet been undertaken as part of the ground investigation on site.

13.3.27 Groundwater level data available for this assessment is limited, with monitoring data available from two boreholes within the upper aquifer; this has meant that hydraulic gradients could only be estimated across the site. In addition, 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 within the upper aquifer.

13.3.28 Despite the limitations identified above, the assessment, which uses the best available information, has been considered robust.

[ix] Storativity – the volume of water released for a unit change in water level (in a confined aquifer)

[x] Hydraulic gradient – the slope of the water table which drives groundwater movement

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.

13.4.2 This section of the assessment is supported by Vol 23 Appendix K.1 – K.9.

Current baseline

Hydrogeology

13.4.3 The depth of the CSO drop shaft would probably pass through Made Ground, River Terrace Deposits, 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 23 Figure 13.4.1 and Vol 23 Figure 13.4.2 respectively (see separate volume of figures).

13.4.4 The River Terrace Deposits form the upper aquifer and are classified by the EA as a secondary A aquifer. The Upnor Formation, Thanet Sands and Chalk form the lower aquifer and are classified by the EA as a principal aquifer. The thickness of the Lambeth Group varies considerably over short distances locally and has been found to be absent on site at Deptford Church Street. Therefore there is expected to be hydraulic continuity between the upper and lower aquifers at the Deptford Church Street site.

13.4.5 The depths and thicknesses of the geological layers have been based on boreholes in the vicinity of the Deptford Church Street site: these are boreholes SR1019, SR1018D, PR1023 and SR1020. The locations of these boreholes around the site are shown on Vol 23 Figure 13.4.1 (see separate volume of figures). The depths and thicknesses of geological layers encountered are summarised in Vol 23 Table 13.4.1.

Vol 23 Table 13.4.1 Groundwater – anticipated ground conditions/ hydrogeology

Formation	Top elevation* (mATD)	Depth below river bed (m)	Thickness (m)	Hydrogeology
Made Ground	105.75	0.00	2.90	Hydraulic continuity with upper aquifer**
River Terrace Deposits***	102.85	2.90	5.50	Upper aquifer
Lambeth Group****	97.35	8.40	4.50	Aquitards[xi]/aquifers

[xi] Aquitard - a poorly-permeable geological formation that does not yield water freely, but may still transmit significant quantities of water to or from adjacent aquifers.

Formation	Top elevation* (mATD)	Depth below river bed (m)	Thickness (m)	Hydrogeology
Thanet Sand*****	92.85	12.90	16.00	Lower aquifer
Seaford Chalk	76.85	28.90	Not proven	

** Based on an assumed ground level of 105.75mATD.*
***It has been assumed that the made ground and alluvium are in hydraulic connectivity for the purposes of this assessment.*
****At on site boreholes SA4031 and SR4117, the River Terrace Deposits were found to be 12.1m and 13.2m thick respectively.*
***** At two on site boreholes SA4031 and SR4117, no Lambeth Group was encountered. This is consistent with published geological map of the area.*
****** At on site boreholes SA4031 and SR4117, the Thanet Sand were found to be14.7m and 12.6m thick respectively.*

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 The nearest boreholes for which information on groundwater levels has been collected are from four off site ground investigation boreholes located within 440m from the site (PR1023, SR1018D and SR1019 and SR1020). These boreholes have response zones[xii] in the River Terrace Deposits, Thanet Sand and Seaford Chalk and are monitoring groundwater levels in both the upper (PR1023) and lower aquifer (SR1018D, SR1019 and SR1020). The locations are shown in Vol 23 Figure13.4.3 (see separate volume of figures). Vol 23 Table 13.4.2 summarises the minimum, average and maximum water levels at the three ground investigation boreholes. Further detail on water level monitoring is provided in Vol 23 Appendix K.3.

Vol 23 Table 13.4.2 Groundwater – recorded water levels

Monitoring borehole ID	Formation	Average over period of record (mATD)	Minimum (mATD)	Maximum (mATD)
PR1023 (U)	River Terrace Deposits	97.48	96.98	97.77
PR1023 (L)	Thanet Sands	97.54	96.99	97.93
SR1018D	Thanet Sands	97.50	97.03	97.78

[xii] Response zone – the section of a borehole that is open to the host strata (EA, 2006)

Monitoring borehole ID	Formation	Average over period of record (mATD)	Minimum (mATD)	Maximum (mATD)
SR1019	Seaford Chalk	97.27	96.83	97.64
SR1020	Seaford Chalk	97.77	97.46	98.03
TQ37/254A	Seaford Chalk	97.70	96.74	98.91

13.4.8 The recorded water levels in the River Terrace Deposits at PR1023 remain below the top of the formation, indicating that the River Terrace Deposits are unconfined and not fully saturated at this location. For the purposes of this assessment, it is assumed that the upper aquifer is in hydraulic continuity with the overlying layers, Alluvium and Made Ground.

13.4.9 The water levels (piezometric head[xiii]) in the Thanet Sands are monitored at two locations. The recorded water levels at SR1018D and PR1023 are very similar and remain above the top of the formation, indicating that the Thanet Sands are fully saturated at this location. The recorded water levels are also very similar to recorded water levels in the River Terrace Deposits at PR1023. This suggests that these units are in hydraulic continuity.

13.4.10 The water levels (piezometric head) in the Seaford Chalk at SR1019 and SR1020 remain above the top of the formation, indicating that the Seaford Chalk is fully saturated at this location. The recorded water levels are also very similar to recorded water levels in the River Terrace Deposits and Thanet Sands at PR1023. This suggests that these units are in hydraulic continuity.

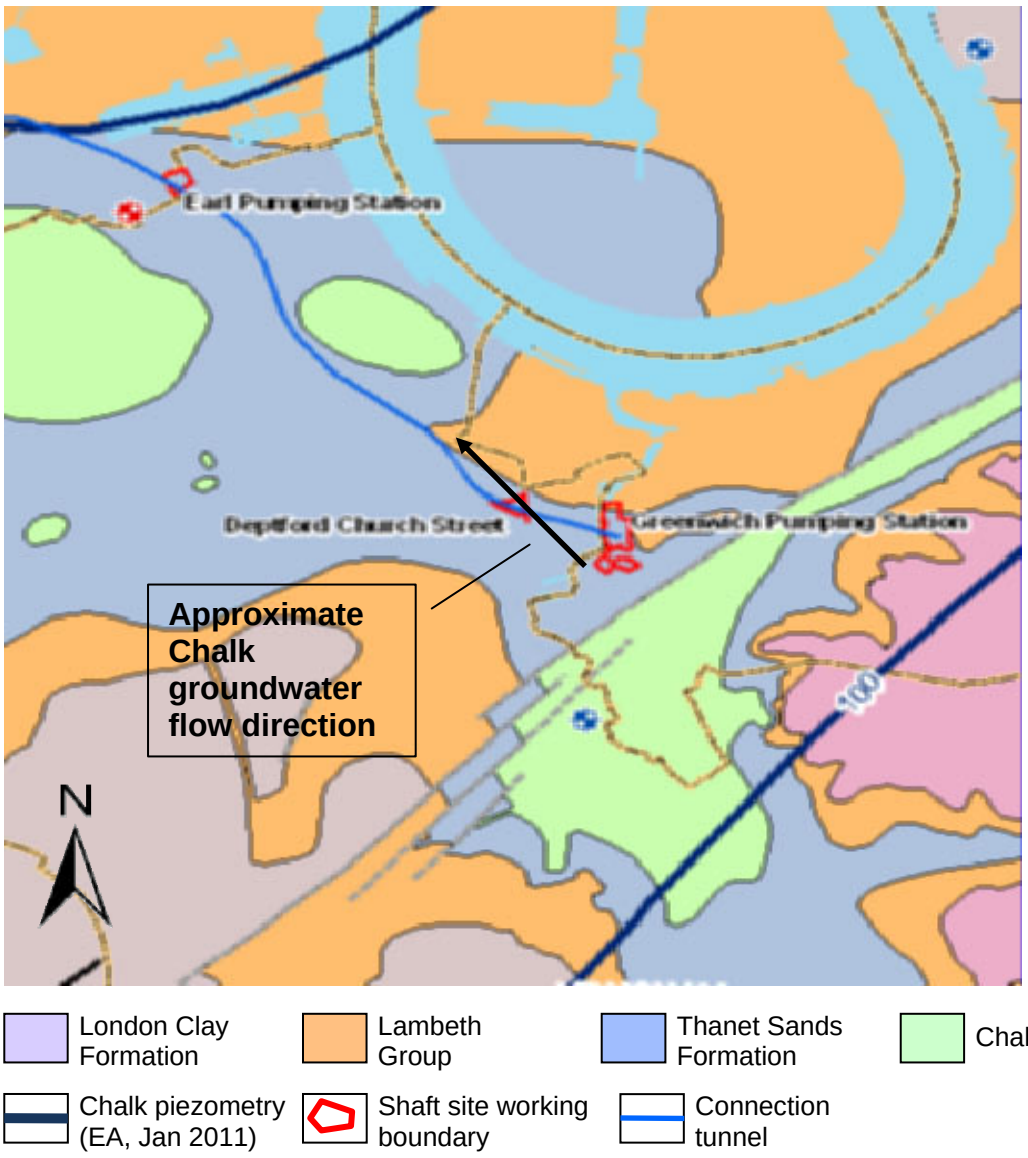
13.4.11 The nearest EA groundwater level monitoring boreholes are located approximately 0.4km east from the Deptford Church Street site, reference numbers TQ37/254A, TQ37/254BL and TQ37/254BU. These boreholes record levels in the lower aquifer (mainly Chalk) and the locations are shown on Vol 23 Figure 13.4.4 (see separate volume of figures). These three boreholes show very similar water levels; therefore the manual dip and logger data collected from TQ37/254A only is shown in Vol 23 Table 13.4.2. The recorded water levels here are approximately similar to levels recorded in the River Terrace Deposits and Thanet Sands at PR1023 and in the Chalk at SR1019, suggesting that these units are in hydraulic continuity.

13.4.12 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). The January 2011 map indicates that the regional

[xiii] Piezometric head – the level or pressure head to which confined groundwater would rise to in a piezometer if it is open to the atmosphere.

direction of groundwater flow (perpendicular to groundwater contours) at this point in time was northwest in the Chalk around Deptford (see Vol 23 Plate 13.4.1). However the site lies within the capture zone for a major public water supply source located to the south, which is likely to reverse the regional groundwater flow direction here to towards the southeast. As the River Terrace Deposits, the Thanet Sands and the Seaford Chalk appear to be in hydraulic continuity, it is likely that the groundwater flow direction in the River Terrace Deposits would also be in a southeast direction in this area.

Vol 23 Plate 13.4.1 Groundwater – Chalk water level contour map



**Extract from Vol 23 Figure 13.4.2 (see separate volume of figures)*

Licensed abstractions

13.4.13 There are no licensed groundwater abstractions from the River Terrace Deposits or upper aquifer located within 1km of the Deptford Church Street site; however, there is one licensed groundwater abstraction from the Chalk or lower aquifer.

13.4.14 Licence number 28/39/43/0019 is located within a kilometre to the south of the Deptford Church Street site and is held by Thames Water Utilities Limited. The groundwater abstracted is used for public supply purposes and is abstracted from six licensed abstraction points. Further details of this licensed abstraction are given in Vol 23 Appendix K.4, Vol 23 Table K.6.

13.4.15 There are no known unlicensed groundwater abstractions recorded within a 1km radius of the Deptford Church Street site.

Groundwater source protection zones

13.4.16 The EA defines SPZ around all major public water supply abstractions sources and large licensed private abstractions in order to safeguard groundwater resources from potentially polluting activities.

13.4.17 The Deptford Church Street site lies within the modelled SPZ 2 (defined by 400 days travel time to the source) and the modelled SPZ 3 (defined as the total capture zone) for the Thames Water Utilities source from the Chalk is located at 0.9km to the south. The distance from the site to the boundary of the modelled SPZ 1 (defined by 50 day travel time to the source) is approximately 160m (see Vol 23 Figure 13.4.2 in separate volume of figures). This source is located up the regional hydraulic gradient expected beneath the CSO site although abstraction itself is likely to reverse the regional groundwater flow direction at Deptford Church Street so that flow is towards the southeast.

Environmental designations

13.4.18 There are no designations relevant to groundwater in the vicinity of the Deptford Church Street site.

Groundwater quality and land quality

13.4.19 Historical land use mapping at the Deptford Church Street site, reviewed as part of the land quality assessment, identified no on site but several nearby potentially contaminative land uses (Vol 23 Section 8)

13.4.20 The groundwater quality data presented in Vol 23 Appendix K, Vol 23 Table K.7 has been sourced from the ground investigation and monitoring works undertaken as part of the Thames Tideway Tunnel project and includes data from monitoring boreholes located off site and within 0.9km away (for boreholes and locations see Vol 23 Figure13.4.1 in separate volume of figures) and within the River Terrace Deposits and Chalk. The data has been compared with the UK drinking water standards[6] or relevant Environmental Quality Standards (EQS) (Defra, 2010)[7].

13.4.21 The data show exceedances of the relevant standards with respect to chloride, iron, manganese, nickel, polycyclic aromatic hydrocarbons (PAHs) and sulphate within the River Terrace Deposits at SA4031 and SR6902 (both on site), with respect to aluminium and iron within the Chalk at SR6902D and SR4117 (both on site) and with respect to total aromatic hydrocarbons, heavy metals, hydrocarbons, PAHs, electrical conductivity, chloride, magnesium, sodium, sulphate, pesticides, herbicides and turbidity within the Chalk at various ground investigation points at distance from the site. Further details are provided in Vol 23 Appendix K.3.

13.4.22 The data suggests that only slightly brackish conditions exist within the River Terrace Deposits at SA4031 on site, although there are more saline conditions present to the east of the site in both the River Terrace Deposits (SR1024) and within the Chalk at SR1040, SR1041 and SR1042, due to its location in closeness of the tidal Thames in this area. Further details are included in Vol 23 Appendix K.7.

13.4.23 The land quality data from the ground investigation boreholes used in the groundwater quality assessment show exceedances of the human health screening values (EA, 2009)[8] (soil guideline values designed to be protective of human health) within the River Terrace Deposits and the Thanet Sands with respect to hydrocarbons. Further detail is provided in the land quality assessment (see Vol 23 Appendix F).

Groundwater flood risk

13.4.24 There are no reported incidences of groundwater flooding in the vicinity of the site, based on information from the LB of Lewisham Strategic Flood Risk Assessment (SFRA) (Jacobs, 2008)[9].

Groundwater receptors

13.4.25 Groundwater receptors which could be affected during construction or operation are summarised in Vol 23 Table 13.4.3. Both the upper and lower aquifers have been assessed as receptors as both would be penetrated by the CSO drop shaft at the Deptford Church Street site.

Vol 23 Table 13.4.3 Groundwater – receptors

Receptor	Construction	Operation	Comment
Groundwater body – upper aquifer	✓	✓	Penetrated by CSO drop shaft, interception chamber & culverts
Groundwater body – lower aquifer	✓	✓	CSO drop shaft and base slab extend into lower aquifer
Licensed abstractions – lower aquifer	×	×	No dewatering of the lower aquifer external to the diaphragm walls and licensed abstraction at 0.9km from site
Licensed abstractions – upper aquifer –	×	×	No dewatering of upper aquifer external to diaphragm walls and no licensed abstractions within 1km of site
Unlicensed	×	×	No known

Receptor	Construction	Operation	Comment
abstractions			unlicensed abstractions within 1km radius of site
Proposed developments	×	×	No planned licensed abstractions or Ground Source Heat Pumps (GSHPs)

**Symbols ✓ applies × does not apply*

Receptor sensitivity

13.4.26 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 (see para 13.4.22) as a result of its location. Therefore it is categorised as being of low value with regard to quality at this location.

13.4.27 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. While the baseline groundwater quality data suggest brackish conditions and contamination here, the presence of a major public water supply source locally suggests that these conditions are localised. Therefore the lower aquifer remains as being of high importance with regard to quality.

13.4.28 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.

13.4.29 A summary of receptor sensitivities used in the assessments that follow are included in Vol 23 Table 13.4.4.

Vol 23 Table 13.4.4 Groundwater – receptor value/ sensitivity

Receptor	Value/sensitivity
Groundwater quality	
Upper aquifer	Low value; secondary A aquifer with brackish conditions and no licensed abstractions within 1km of site.
Lower aquifer	High value; principal aquifer and within SPZ 2 of public water supply source.
Groundwater quantity (resources)	
Upper aquifer	Medium value; secondary A aquifer.
Lower aquifer	High value; principal aquifer.
Licensed Chalk abstraction	High value, drinking water supply source.

Receptor	Value/sensitivity
28/39/43/0019	

Construction base case

13.4.30 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 Deptford Church Street site and would have the potential to lead to a change to groundwater in the upper and lower aquifers.

13.4.31 The basements associated with other developments identified in Vol 23 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.

13.4.32 None of the proposed developments identified in Vol 23 Table 13.3.1 would impact on the lower aquifer and it can be concluded that there would be no change to the base case in Site Year 1 of construction.

Operational base case

13.4.33 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 diaphragm walls to below the base of the CSO drop shaft or from within piled walls. No licensed abstractions have been identified; therefore the magnitude of this impact on the upper aquifer has been anticipated to be negligible.

13.5.2 For the construction of the Thames Tideway Tunnel project as a whole, groundwater levels in the lower aquifer would have to be lowered by dewatering to allow construction of the main tunnel shafts, CSO drop shafts and below ground structures. The impact of project-wide dewatering is discussed in detail in Vol 3 Section 13. Impacts have been quantified by modelling (see Vol 3 Section 13 Appendix K.2) and the effects, where they are of relevance to the Deptford Church Street site, are included in this assessment.

13.5.3 The design at the Deptford Church Street site allows for diaphragm walls which would hydraulically isolate the inside of the CSO drop shaft (and depending on the success of grouting also the base) from the aquifers. An estimate of the amount of dewatering which is anticipated to be needed at

the Deptford Church Street site is less than 200m^3/d and this would be abstracted from within the diaphragm walls. 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])[10].

13.5.4 Details of the groundwater modelling undertaken to inform the assessment of likely significant effects at Deptford Church Street are included in Vol 3 Appendix K.2. The current EA and Thames Tideway Tunnel project groundwater level monitoring (see the draft groundwater monitoring strategy Vol 3 Appendix K.1) already reflects the pumping from the public water supply source located to the south (see para. 13.4.14).

13.5.5 There would be additional drawdown (lowering of groundwater levels) of the lower aquifer as a result of project-wide dewatering. The full details of the effects on licensees in the vicinity of the Deptford Church Street site are set out in the modelling report (see Vol 3 Section 13 Appendix K.2). For each licensee the impact of drawdown is assessed by comparing it to the maximum assessed available drawdown (MAAD)[xiv] at the licensee's borehole(s).

13.5.6 In the case of licence number 28/39/43/0019 (Thames Water Utilities Ltd.), modelling has predicted a maximum drawdown of 0.7m, which is less than the MAAD of 5m. The magnitude of impact has been assessed to be negligible.

Groundwater quality

13.5.7 The baseline groundwater quality data from nearby ground investigation boreholes shows exceedances in the River Terrace Deposits and in the Chalk with respect to chloride and sodium, indicating brackish conditions. However, the presence of a major public water supply source at 0.9km to the south of the Deptford Church Street site suggests that these conditions are localised. 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 13).

13.5.8 The data also show exceedances with respect to heavy metals, hydrocarbons, PAHs, pesticides, herbicides and turbidity in groundwater within the Chalk at ground investigation and monitoring boreholes located between 230m and 580m from the Deptford Church Street site.

13.5.9 The CSO drop shaft construction may create a pathway for groundwater movement between the drop shaft and the ground, where an effective seal is not in place. However, diaphragm walls would seal out the upper aquifer and any water encountered would be pumped out and disposed of

[xiv] Maximum assessed 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; whichever is least of these two values.

appropriately, following the measures identified within the *CoCP* (and detailed in Section 13.2). Given the preceding approach, the magnitude of the impact on the upper aquifer is 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 abstraction (see para 13.4.14) is located to the south, up hydraulic gradient of the CSO site and therefore would not be at risk. In addition, any dewatering of the lower aquifer would be internal to the diaphragm walls and that any water encountered would be pumped out and disposed of appropriately, following the measures identified within the *CoCP* (and detailed in Section 13.2), the magnitude of the impact on the lower aquifer has been assessed to be negligible.

13.5.11 The potential for movement of contamination at the Deptford Church Street site by project-wide dewatering is discussed in Vol 3 Section 13.

13.5.12 Ground treatment is anticipated to be required in the upper aquifer for the construction of the interception works. Given that internal dewatering this would minimise the potential movement of grout contaminated groundwater, the impact on groundwater quality within the upper aquifer has been assessed to be negligible.

13.5.13 Ground treatment is anticipated to be required within the Chalk for the construction of the CSO drop shaft and to facilitate the TBM break in/out. Materials and practices such as fissure grouting in high transmissivity Chalk within a SPZ 2 would have the potential to impact groundwater quality at a major public water supply source. However, given that internal dewatering would minimise the potential movement of grout contaminated groundwater, the impact on groundwater quality within the lower aquifer has been 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. Project-wide dewatering within the lower aquifer would draw water levels down at the Deptford Church Street site by less than 1m and this level of drawdown at Deptford is not anticipated to result in the water level dropping below the top of the Thanet Sands. 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 13.

Physical obstruction

13.5.15 The construction of underground structures may disrupt groundwater flow and alter groundwater levels in both the upper and lower aquifers.

13.5.16 The method for assessing the impact of all below ground activities upon the groundwater levels in the upper aquifer is described in Vol 2 Appendix K.1. It is estimated that the groundwater level would rise during the construction phase at Deptford Church Street by approximately 0.2m, based on an estimated hydraulic gradient of 0.004.

13.5.17 Based on the limited available data, groundwater levels in the upper aquifer can reach 98mATD, which is approximately 7.8m below the existing ground surface at Deptford Church Street (around 105. 8mATD). Given the small predicted rise in water levels (0.2m) on the north-western side of the Deptford Church Street site, the change in groundwater levels as a result of physical obstruction would result in a negligible magnitude of impact on the upper aquifer.

13.5.18 The construction activities associated with the CSO drop shaft may form a physical obstruction to groundwater flow around the shaft within the lower aquifer. The CSO drop shaft would extend into the lower aquifer by approximately 39m and would have an external diameter of approximately 22m. The lower aquifer is up to 100m thick and therefore the physical obstruction would be relatively small in comparison to cross-sectional area of the aquifer. In addition, the impact would be reduced by virtue of the distance to the nearest abstraction point of 0.9km. The impact of physical obstruction on the lower aquifer and on this source has been assessed negligible.

Construction effects

13.5.19 By combining the impacts identified above with the receptor importance in Section 13.4 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 aquifer units

13.5.20 Localised dewatering of the upper aquifer may be required; however this would be internal to diaphragm walls or piled walls for the interception chamber and culvert, and there are no licensed abstraction sources from the upper aquifer located within 1km of the Deptford Church Street site. A negligible impact on a medium value receptor, the upper aquifer, would result in a **negligible** effect.

13.5.21 Dewatering of the lower aquifer would be internal to the diaphragm walls and small in volume. 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.

13.5.22 In addition, the project-wide effects of dewatering would not result in an exceedance of the MAAD at the licensed abstraction source from the lower aquifer located within 1km radius of the Deptford Church Street site (28/39/42/0019). A negligible impact on a high value receptor would result in a **minor adverse** effect.

Groundwater quality

13.5.23 No groundwater contamination has been identified within the upper aquifer in close proximity to the Deptford Church Street site and diaphragm walls or piled walls would limit any movement of contaminated groundwater should it be encountered. A negligible impact on groundwater quality of a medium value receptor, the upper aquifer, would result in a **negligible** effect.

13.5.24 Grouting is anticipated to be required within the upper aquifer; however the diaphragm walls or piled walls would limit the movement of any contaminated groundwater. A negligible impact on groundwater quality on a medium value receptor, the upper aquifer, would result in a **negligible** effect.

13.5.25 Groundwater contamination has been identified within the lower aquifer in close proximity to the Deptford Church Street site; however, dewatering of the lower aquifer would be internal to the diaphragm walls thereby limiting any movement of contaminated groundwater. A negligible impact on groundwater quality of a high value receptor, the lower aquifer, would result in a **minor adverse** effect.

13.5.26 Fissure grouting is anticipated to be required within the Chalk, which would have the potential to impact groundwater quality at a major public water supply source; however diaphragm walls installed to below the base of the CSO drop shaft would limit any movement of contaminated groundwater. A negligible impact on groundwater quality of a high value receptor, the lower aquifer, would result in a **minor adverse** effect.

13.5.27 No drawing down of groundwater levels below the top of the Thanet Sand and associated potential deterioration of groundwater quality is anticipated at the Deptford Church Street site. A negligible impact on groundwater quality of a high value receptor, the lower aquifer, would result in a **minor adverse** effect.

Physical obstruction

13.5.28 The 0.2m rise in groundwater levels in the upper aquifer as a result of obstruction is small compared to the estimated unsaturated zone at the CSO site. A negligible impact on a medium value receptor, the upper aquifer, would result in a **negligible** effect.

13.5.29 The physical impact of the CSO drop shaft upon the lower aquifer is reduced by the thickness of the lower aquifer and by the distance to the nearest licensed abstraction source. A negligible impact on a high value receptor, the lower aquifer, would result in a **minor adverse** effect.

13.6 Operational effects assessment

Operational impacts

Physical obstruction

13.6.1 The presence of the operational CSO drop shaft, the connection culvert and other chambers in the upper aquifer may disrupt local groundwater flow and alter groundwater levels.

13.6.2 The method for assessing the impact of the main tunnel and CSO drop shafts upon the groundwater levels in the upper aquifer is described in Vol 2 Appendix K.2. It is estimated that the groundwater level rise during the operational phase at Deptford Church Street by less than 0.1m, based on an estimated hydraulic gradient of 0.004.

13.6.3 The predicted rise in water levels within the upper aquifer of less than 0.1m on the northwest side of the structure is small compared to the

estimated available headroom within the upper aquifer of approximately 7.8m. Therefore the magnitude of this impact on the upper aquifer has been assessed as negligible.

13.6.4 The impact of the CSO drop shaft upon the lower aquifer is reduced by the thickness of the lower aquifer and by the distance to the nearest licensed abstraction source. Therefore the magnitude of this impact on the lower aquifer has been assessed as negligible.

Seepage from CSO drop shaft

13.6.5 An estimate of the theoretical seepage volumes from the CSO drop shaft at Deptford Church Street site 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 (Vol 3 Section 13). The estimated volume of seepage from the drop shaft into the upper aquifer is 1.6m^3/annum (Table K.5). The higher heads outside the CSO drop shaft means that any risk of seepage from the CSO drop shaft into the upper aquifer would be further reduced. The magnitude of impact has been assessed as negligible for the upper aquifer.

13.6.6 The estimated volume of seepage from the CSO drop shaft into the lower aquifer is 21m^3/annum (Vol 2 Appendix K Table K.5). The magnitude of impact has been assessed as negligible for the lower aquifer.

Seepage into CSO drop shaft

13.6.7 An estimate of the theoretical seepage volumes into the CSO drop shaft at Deptford Church Street is included in Vol 2 Appendix K.3. The estimated loss of water resources from the upper aquifer is 55m^3/annum (Vol 2 Appendix K Table K.4) and is assessed as negligible for the upper aquifer.

13.6.8 The estimated loss of water resources from the lower aquifer is 698m^3/annum which is considered to be a negligible impact.

13.6.9 No other operational impacts are envisaged.

Operational effects

13.6.10 By combining the receptor value (Vol 23 Table 13.4.4) importance with the impacts 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 Altering groundwater levels on the northwest side of the CSO drop shaft would be a negligible impact on a medium value receptor (upper aquifer) would lead to a **negligible** effect on groundwater quantity in the upper aquifer.

13.6.12 The same impact on a high value receptor (lower aquifer), would lead to a **minor adverse** effect on groundwater quantity in the lower aquifer.

Seepage from CSO drop shaft

13.6.13 Seepage from the CSO drop shaft has been determined as a negligible impact, on a medium value receptor (the upper aquifer), would lead to a **negligible** effect on groundwater quality in the upper aquifer.

13.6.14 The same impact on a high value receptor (the lower aquifer) would lead to a **minor adverse** effect on groundwater quality in the lower aquifer.

Seepage into CSO drop shaft

13.6.15 Seepage into the CSO drop shaft has been determined as a negligible impact, on a medium value aquifer (the upper aquifer), would lead to a **negligible** effect on groundwater quantity in the upper aquifer.

13.6.16 The same impact on a high value receptor (the lower aquifer), gives an overall **minor adverse** effect on groundwater quantity in the lower aquifer.

13.7 Cumulative effects assessment

Construction effects

13.7.1 Two developments identified in Vol 23 Table 13.3.1 could give rise to cumulative effects to groundwater in the upper aquifer through the inclusion of basements. Although there may be a local impact on groundwater levels in the upper aquifer due to the vicinity of the developments, any effects are not expected to be significant because the developments are all greater than 50m away from the CSO site. Any substantive changes to the baseline conditions prior to construction would be detected by ongoing monitoring.

13.7.2 These developments would not impact on the lower aquifer, and therefore there would be no cumulative effects in the lower aquifer. The effects on groundwater during construction would remain as described in Section 13.5.

Operational effects

13.7.3 No cumulative operational effects assessment is required as development schemes identified already form part of the base case prior to the operational phase of the Thames Tideway Tunnel project. Therefore, the effects on groundwater during operation would remain as described in Section 13.6.

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 assessment and no mitigation is required.

13.8.3 The potential for movement of contamination at the Deptford Church Street site by project-wide dewatering is discussed in Vol 3 Section 13.

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 23 Table 13.10.1 Groundwater – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Upper aquifer (licensed Chalk abstractions)	Lowering of groundwater levels	Negligible	None	Negligible
Lower aquifer (licensed Chalk abstractions)	Lowering of groundwater levels in the Chalk resulting from dewatering	Lower aquifer – Minor adverse 28/39/43/0019 –Minor adverse	None	Minor adverse
Upper aquifer (groundwater quality)	Deterioration in groundwater quality caused by creation of a pathway	Negligible	None	Negligible
	Deterioration in water quality from grouting	Negligible	None	Negligible
Lower aquifer (groundwater quality)	Deterioration in groundwater quality caused by creation of a pathway	Minor adverse	None	Minor adverse
	Deterioration in water quality in the Chalk from grouting	Minor adverse	None	Minor adverse
	Drawing down of groundwater levels below top of Thanet Sand	Minor adverse	None	Minor adverse
Upper aquifer	Change in groundwater storage and flood risk as a result of physical obstruction	Negligible	None	Negligible
Lower aquifer	Change in groundwater storage as a result of physical obstruction	Minor adverse	None	Minor adverse

Vol 23 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	Deterioration in water quality in the upper aquifer from seepage out of drop shaft	Negligible	None	Negligible
Lower aquifer	Deterioration in water quality in the lower aquifer from seepage out of drop shaft	Minor adverse	None	Minor adverse
Upper aquifer	Seepage into drop shaft affecting groundwater resources	Negligible	None	Negligible
Lower aquifer	Seepage into drop shaft affecting groundwater resources	Minor adverse	None	Minor adverse

References

[1] Defra. *National Policy Statement for Waste Water* (2012)

[2] Environment Agency. *Introducing pollution prevention: PPG 1 – EA Consultation* (2011).

[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 2011).

[5] British Geological Survey. British geology onshore digital maps 1:50 000 scale. Received from Thames Tunnel, February 2009.

[6] The Water Supply (Water Quality) Regulations,(2000). Available at: http://www.legislation.gov.uk/uksi/2000/3184/contents/made

[7] Defra. River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction (2010). Available at: http://www.defra.gov.uk/environment/quality/water/legislation/water-framework-directive/

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 14: Water resources - surface water

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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 23: Deptford Church Street 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 Deptford Church Street 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 at the Deptford Church Street site and in particular in relation to the interception of Deptford Storm Relief combined sewer overflow (CSO). It is however important to recognise that whilst the reductions in spills from the Deptford Storm Relief CSO would be important to water quality in the immediate area of the CSO at national grid reference (NGR) 5374, 1780, 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 the proposed Thames Tideway project are assessed separately and 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 23 Deptford Church Street 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 approximately 600m south of the River Thames and 250m west of Deptford Creek. 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 base of the shaft would require dewatering and/or ground treatment. However, internal dewatering of the shaft diaphragm 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.

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

[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).

settling tanks, separators and other measures prior to discharge to 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 no site specific measures incorporated in the CoCP Part B (Section 8) relevant to the surface water assessment. There is a measure in CoCP Part B (Section 8) for this site that relates to permeable surfacing; this is only of relevance to the FRA contained in Section 15 of this volume.

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 at Deptford Storm Relief CSO. Therefore, there would 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 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. A WFD assessment for the project as a whole is presented in Vol 3 Section 14.

Engagement

14.3.1 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. The *Scoping Report* was prepared before the Deptford Church Street site was identified as a potential site. The scope for the assessment of surface water for this site has therefore drawn on the scoping response from the LB of Lewisham and is based on professional judgement as well as experience of similar sites.

14.3.2 There are no site-specific engagement comments relevant to the surface water assessment at the Deptford Church Street site.

Baseline

14.3.3 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

14.3.4 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.

14.3.1 The assessment year for construction effects is Site Year 1 (2016) 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 2016 and 2021.

14.3.2 The Lee Tunnel and the sewage works upgrades proposed 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.

14.3.3 The construction base case has considered the developments that are scheduled to be complete and in operation by Site Year 1 (see Vol 23 Appendix N). The developments in Appendix N would not result in additional surface water receptors (ie, waterbodies) and are considered unlikely to result in changes in water quality as the majority of these developments are remote from the tidal Thames. The base case would therefore not change from that outlined above.

14.3.4 The assessment area for the assessment of effects of construction activities at the Deptford Church Street site is the Thames Middle waterbody, as well as the Deptford Creek waterbody listed below in Vol 23 Table 14.4.1.

14.3.5 Section 14.5 details the likely significant effects arising from the construction at the Deptford Church Street 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.

14.3.6 Phases of some of the developments identified in Vol 23 Appendix N would be under construction during Site Year 1. These developments

have been considered in the cumulative effects assessment (see Section 14.7).

Operation

14.3.7 The operational 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.

14.3.8 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 for 2080.

14.3.9 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 Year 1 of operation (see Vol 23 Appendix N). The developments in Appendix N would not result in additional surface water receptors (ie, waterbodies) and are considered unlikely to result in changes in water quality as the majority of these developments are remote from the tidal Thames. The base case would therefore not change from that outlined above. .

14.3.10 The operational assessment uses the same assessment area identified above for the construction assessment.

14.3.11 The Heathside and Lethbridge Estate development would be under construction during Site Year 1 of operation and has been considered in the cumulative effects assessment (see Section 14.7).

14.3.12 Section 14.6 details the likely significant effects arising from the operation at the Deptford Church Street site.

Assumptions and limitations

14.3.13 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 base of the shaft would require dewatering and/or ground treatment. There are no 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 (EA, 2009)[4] (RBMP), or downstream of the site

and therefore have the potential to be affected by the proposed development, is included in Vol 23 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].

Vol 23 Table 14.4.1 Surface water – receptors

Waterbody name/ID	Hydro-morphological 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
Deptford Creek	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 its 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 water resource, habitat and source of amenity, recreation, and transport route throughout London.

14.4.5 Deptford Creek is not assessed under the WFD. However, as it forms part of the Thames Middle waterbody, which has a target status of good by 2027, the Deptford Creek should also be assumed to have a target status of good. It is therefore considered to be a high value waterbody, due to the target of good status.

14.4.6 Sediment levels within the tidal Thames are estimated to currently reach a peak of 4,000kg/s in the lower 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 Deptford Church Street site.

14.4.8 The Deptford Church Street Storm Relief CSO lies between the EA's spot sample sites on the Ravensbourne at Deptford Bridge and Greenwich, as shown on Vol 23 Figure 14.4.1 (see separate volume of figures). 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 (concentration exceeded 90% of the time), is presented below in Vol 23 Table 14.4.2.

Vol 23 Table 14.4.2 Surface water – 2011 spot samples

EA spot sample site	Nitrogen (mg/l) as 90%ile	DO (mg/l) as 10%ile
Greenwich	10.22	3.59
Ravensbourne at Deptford Bridge	5.13	Not measured

14.4.9 Classification of dissolved oxygen (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 Deptford Church Street Storm Relief 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 (at Deptford Church Street Storm Relief CSO) and a more widespread effect along the tidal Thames of rapidly dropping DO levels Vol 3 Section 14 details half-tide plots displaying the changes in DO levels along the tidal Thames.

14.4.11 Historic contamination of underlying soils as a result of the clearance of previous housing (potential for backfilled basements: contamination could include coal ash, clinker, metals and polycyclic aromatic hydrocarbons [PAHs]) has been identified at the Deptford Church Street site. In addition, shallow groundwater contamination from historic and existing industries including former gas and chemical works, depots and former factories is anticipated. An assessment of potential on-site contamination is provided within Section 8 of this volume.

Current CSO operation

14.4.12 The current operation of the Deptford Church Street Storm Relief 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 has been defined as follows:

a. the CSO spills on average 36 times in the Typical Year[ii]

b. the CSO spills for a total duration of 252 hours in the Typical Year

c. the spill volume from the CSO is approximately 1,470,000m^3 in the Typical Year, representing 3.7% of the total volume discharged to the tidal Thames in the Typical Year from all CSOs.

14.4.13 Using the same catchment model, the annual polluting loading of biochemical oxygen demand (BOD), ammonia and total Kjeldahl nitrogen

[ii] 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

(TKN) (the sum of organic nitrogen, ammonia [NH_3], and ammonium [NH_4^+]) of spill from the Deptford Church Street Storm Relief CSO has been defined as follows:

a. the CSO discharges 142,000kg of BOD in the Typical Year

b. the CSO discharges 4,800kg of ammonia in the Typical Year

c. the CSO discharges 22,000kg of TKN in the Typical Year.

14.4.14 Each discharge also 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 et al, 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[iii]. 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.

14.4.15 Assuming the average 36 spills per annum from the Deptford Church Street Storm Relief CSO occur on separate days, there could be up to a maximum of 144 days per year where recreational users are at risk of exposure to pathogens in the vicinity of the outfall as a result of the Deptford Church Street Storm Relief CSO alone (Lane, C, Surman-Lee, S, Sellwood, J and Lee, JV, 2007, 2007)[10].

14.4.16 The operation of Deptford Church Street Storm Relief CSO results in the discharge of sewage litter along with the discharge of effluent. It has been estimated by the Thames Tideway 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 Deptford Church Street Storm Relief CSO and assuming litter tonnages are proportional to discharge volumes, this would indicate that approximately 371t of sewage derived litter is discharged from the Deptford Church Street Storm Relief CSO in the Typical Year. An assessment of the amenity effects of the sewage litter is given in Vol 3 Section 10 – Socio-economics.

Construction base case

14.4.17 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.

14.4.18 The base case in Site Year 1 of construction taking into account the schemes described in Section 14.3 would not change since no would not

[iii] The EA has provided advice on CSO excursion areas[iii], 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.

change since no new sensitive receptors (waterbodies) would be introduced.

Operational base case

14.4.19 As noted above, the operational 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.

14.4.20 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.

14.4.21 Catchment modelling results of the base case have demonstrated that by Year 1 of operation (assessed using 2021 modelled assumptions) the frequency, duration and volume of the Deptford Church Street Storm Relief CSO would have increased (as a result of increased population) beyond the current baseline as follows:

a. the CSO would spill 39 times in the Typical Year (three more than the current baseline)

b. the CSO would spill for a total duration of 342 hours in the Typical Year (90 hours more than the current baseline)

c. the spill volume from the CSO would be approximately 1,980,000m^3 in the Typical Year (510,000m^3 more than the current baseline).

14.4.22 The same catchment 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 237,000kg of BOD in the Typical Year (95,000kg more than the current baseline)

b. the CSO would discharge 8,400kg of ammonia in the Typical Year (3,600kg more than the current baseline)

c. the CSO would discharge 36,500kg of TKN in the Typical Year (15,000kg more than the current baseline).

14.4.23 Following on from the interpretation of the current baseline as per para. 14.4.15 the number of risk days for river users being exposed to pathogens during the operational base case year (taking into account 2021 modelled assumptions) would be a maximum of 156 days in the Typical Year as a result of spills from the Deptford Church Street Storm Relief CSO alone.

14.4.24 Similarly, the tonnage of sewage derived litter discharge from the Deptford Church Street Storm Relief CSO can be expected to increase by approximately 34% from approximately 371t to approximately 500t 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 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 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. Surface water drainage is therefore not considered further within this assessment.

Contamination and dewatering

14.5.3 Based on the geology at the site, the construction of the base of the proposed CSO drop shaft would require dewatering and or ground treatment. Internal dewatering of diaphragm wall is proposed, which would limit the amount of dewatering required to 200m^3 per day. See Section 13 of this volume for further details on the dewatering requirements.

14.5.4 Shallow groundwater contamination from historic and existing industries including former gas and chemical works, depots and former factories has been found. An assessment of potential on-site contamination is provided within Section 8 of this volume. However, settlement of suspended solids within the dewatering would minimise the levels of contaminants within the effluent, which tend to be associated with particulates. Additional treatment of the dewatering effluent, or remediation of groundwater, may also be carried out, if required and it is therefore considered that there is no pollution pathway and hence no impact from dewatering.

Construction effects

14.5.5 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 second part of the section identifies any effects that may occur and the likely significance of these effects.

Operational impacts

Reduction in Deptford Church Street Storm Relief 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 Deptford Church Street Storm Relief CSO would substantially decrease (as a result of the capture of combined sewage into the tunnel) as follows:

a. the CSO would spill four times in the Typical Year (35 times less than the operational base case)

b. the CSO would spill for a duration of 29 hours in the Typical Year (313 hours less than the operational base case)

c. the spill volume from the CSO would be approximately 163,000m^3 in the Typical Year (1,817,000m^3 less than the operational base case).

14.6.3 The frequency, duration and volume of spills at Deptford Church Street Storm Relief CSO would therefore be reduced by approximately 92% as a result of the Thames Tideway Tunnel project.

14.6.4 Given the reduction in spills, the number of risk days in which river users would be exposed to pathogens in the development case year as a result of spills from the Deptford Church Street Storm Relief CSO would be a maximum of 16 days in the Typical Year (a reduction of up to 140 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 92% from approximately 500t to approximately 41t 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 17,000kg of BOD in the Typical Year (220,000kg less than the operational base case)

b. the CSO would discharge 580kg of ammonia in the Typical Year (7,820kg less than the operational base case)

c. the CSO would discharge 2,500kg of TKN in the Typical Year (34,000kg less than the operational base case).

14.6.7 Catchment modelling of the 2080 development case (to account for the effects of climate change and predicted increases to population) predicts that by 2080 with the project in place, the frequency, duration and volume of the Deptford Church Street Storm Relief CSO would be as follows:

a. the CSO would spill on average five times per year (once more than the Year 1 of operation development case)

b. the CSO would spill for an average duration of 37 hours (eight more than the Year 1 of operation development case)

c. the spill volume from the CSO would be approximately 221,000m^3 per year (58,000m^3 more than the Year 1 of operation development case).

14.6.8 It is predicted that in the 2080 development case scenario the Deptford Church Street Storm Relief CSO would increase in spill frequency, volume and duration. 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.

14.6.9 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

14.6.10 The potential surface water impacts identified above as likely as a result of operation at Deptford Church Street Storm Relief CSO have been assessed for significance against the relevant WFD objectives as described in Vol 2 Section 14 and summarised below.

14.6.11 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.

14.6.12 The significance of these effects has then been assessed based on the magnitude of the effect as described in Vol 2 Section 14.5.

Reduction in Deptford Church Street Storm Relief CSO spills

14.6.13 The reduction in spills from the Deptford Church Street Storm Relief CSO would represent an important contribution towards

a. meeting the requirements of the UWWTD[12] in relation to the Deptford Church Street Storm Relief 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.

14.6.14 Therefore, the reduction in spills would be 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 Deptford Church Street site also depends on the project-wide improvements, as documented in Vol 3 Section 14.

14.6.15 The associated reduction in exposure to pathogens would greatly improve the conditions for recreational users of the tidal Thames around the

Deptford Church Street Storm Relief 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.

14.6.16 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 23 Appendix N, which could potentially give rise to cumulative construction effects with the proposed development at the Deptford Church Street 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 and also because the other developments are not of sufficient scale such that they are likely to generate significant effects in relation to surface water quality.

14.7.3 It is not considered likely that the Heathside and Lethbridge Estate development would give rise to cumulative operational effects with the proposed development at the Deptford Church Street site. This is because the development is remote from the tidal Thames and the other development is not of sufficient scale such that it is not likely to generate significant effects in relation to surface water quality.

14.7.4 No significant cumulative effects have therefore been identified for the construction or operational phases at this site and therefore the effects on surface water would 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 23 Table 14.10.1 Surface water resources – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Thames Middle (including Deptford Creek)	The assessment has not identified any likely significant adverse effects.	N/A	N/A	N/A

Vol 23 Table 14.10.2 Surface water resources – operational assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Thames Middle (including Deptford Creek)	Compliance with UWWTD and WFD. Improved water quality in the vicinity of the Deptford Church Street Storm Relief CSO by reduced pollutant loading and no reduction of dissolved oxygen levels due to reduced spill frequency, duration and volume from Deptford Church Street Storm Relief CSO.	Major beneficial	None	Major beneficial
Thames Middle (including Deptford Creek)	Risk of exposure days to pathogens would be reduced to a maximum of 16 days in the Typical Year (a reduction of up to 128 days of risk of exposure)	Moderate beneficial	None	Moderate beneficial
Thames Middle (including Deptford Creek)	Sewage derived litter discharge at Deptford Church Street Storm Relief CSO would be reduced by approximately 92% 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 Council Directive 91/271/EEC concerning urban waste-water treatment*

[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 (2009). See citation above

[7] Environment Agency (2009). 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, Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0271:EN:NOT*

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street site assessment

Section 15: Water resources - flood risk

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

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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 the Deptford Church Street site, which includes:

a. a qualitative appraisal of the flood risk posed to the site

b. the potential impact of the development on flood risk on and off the site

c. an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels.

15.1.2 The FRA methodology was informed by the *National Policy Statement* (NPS) for Waste Water (Defra, February 2012)[1] and is provided in Volume 2 Environmental assessment methodology Section 15.

15.1.3 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 23 Deptford Church Street Figures).

15.1.4 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.

15.1.5 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 and surface water is presented in Section 13 and Section 14 of this volume respectively.

15.1.6 A project-wide FRA has been undertaken and is presented in Volume 3 Project-wide effects assessment.

Regulatory context

15.1.7 This FRA has been developed in line with the requirements of the NPS for Waste Water (Section 4.4). Further details on how the NPS requirements relevant to flood risk have been met can be found in Vol 2 Section 15.3.

15.1.8 The NPS seeks to ensure that where the development of new waste water 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.

15.1.9 A review of planning policy relevant to the proposed development is provided in Vol 23 Appendix M.1.

NPS Sequential and Exception Tests

15.1.10 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 waste water infrastructure projects can be located in Flood Zone 3 subject to the Exception Test.

15.1.11 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.

15.1.12 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).

15.1.13 The overall Thames Tideway Tunnel project is considered to pass the Sequential Test, as detailed in Vol 3 Section 15. The project-wide Exception Test is also detailed in Vol 3 Section 15.

15.1.14 The proposed development at Deptford Church Street 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.

15.1.15 The majority of the proposed development site is primarily an undeveloped greenfield area. However, as detailed in Vol 3 Section 15 no reasonably alternative sites on developable previously- developed land were identified during the sites selection process and as such the proposed development at Deptford Church Street would satisfy part b) of the Exception Test.

15.1.16 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. The elements of the proposed development relevant to flood risk are set out below.

Construction

15.2.2 The construction elements of the proposed development relevant to flood risk include:

a. an interception chamber, culvert and valve chamber would be constructed to intercept the Deptford Storm Relief Sewer running northwards in Deptford Church Street. The culvert would connect the interception and valve chambers to the combined sewer overflow (CSO) drop shaft, which itself would connect to the Greenwich connection tunnel from the Greenwich Pumping Station site

b. the connection between the Bronze Street combined sewer and the Deptford Church Street combined sewer would be maintained

c. the Deptford Storm Relief sewer would be maintained during the construction phase.

Code of Construction Practice

15.2.3 Appropriate guidance regarding flood defence construction and emergency planning are included in 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).

15.2.4 The *CoCP* (Section 8) 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

15.2.5 The operational elements of the proposed development relevant to flood risk include:

a. the interception of sewage from the Deptford Storm Relief sewer and diversion of flows to the main tunnel by the Greenwich connection tunnel. The Deptford Storm Relief sewer would only spill to the River Thames when the main tunnel becomes full or unavailable or in the case of the system experiencing a storm event with a return period exceeding design

b. surface water would be attenuated onsite and restricted to the greenfield runoff rates prior to being discharged to the sewer network

c. a brown roof is proposed on the electrical kiosk.

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 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 *National Planning Policy Framework* (*NPPF*) (Communities and Local Government, March 2012)[2] was considered to be preferable to the general environmental impact assessment (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 Section 15).

Tidal flood risk to the proposed development

Level of risk based on the flood zones

15.3.5 The site is situated approximately 250m west of the tidal stretch of the Ravensbourne River (known as Deptford Creek) and approximately 600m south of the River Thames. The Environment Agency (EA) Flood Map identifies the majority of the site to lie within Flood Zones 1 and 2, with the far south-east corner of the site located within Flood Zone 3. The location of the site in relation to the flood zones is shown in Vol 23 Figure 15.3.1 (see separate volume of figures). As the site is located inland, and is not classified as functional flood plain, it is considered to lie partially within Flood Zone 3a.

15.3.6 Further detail on tidal flood risk has been obtained from the EA Thames Embayment Modelling (Halcrow, June 2011)[3]. This has provided tidal flood levels for Deptford Creek in the 1 in 200 year (0.5% Annual Exceedance Probability [AEP][i]) and 1 in 1000 year (0.1% AEP) present day undefended scenario, with an operational Thames Barrier. Results of this study (see Vol 23 Table 15.3.2) indicate that the site is located entirely within Flood Zone 1 associated with tidal flood sources.

15.3.7 As the EA flood zone map shows the site as being partially located within Flood Zone 3a, the flood risk from tidal sources is considered to be high (see Vol 2 Section 15).

Existing tidal defences

15.3.8 A raised flood defence wall is located along the eastern banks of Deptford Creek, approximately 250m east of the site.

15.3.9 The EA has stated that the statutory flood defence level relevant to the Deptford Church Street site is 5.23m Above Ordinance Datum (AOD). The National Flood and Coastal Defence Database (NFCDD)[4] crest level of the flood defences near the site at Deptford Creek is between 5.65m AOD and 6.16mAOD.

15.3.10 Condition surveys of the flood defences carried out by the EA in December 2010[5] state that the majority of the flood defences are in good

[i] A flood with a 0.5% AEP has a 1 in 200 chance of occurring in a given year. A flood with a 0.1% AEP has a 1 in 1000 chance of occurring in a given year.

condition (Grade 2) with some areas in a very good condition (Grade 1) and some in a fair condition (Grade 3).

15.3.11 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.

15.3.12 The Strategic Flood Risk Assessment (SFRA) for the London Borough (LB) of Lewisham (JBA, 2008)[6] quantifies the residual risk in the event of a breach in the local defence wall or overtopping as a result of a failure of the Thames Barrier. The southern section of the site is designated in the SFRA as an area of low[7] hazard[ii], whilst the remainder of the site is not identified to be within a hazard zone. However, this risk is residual and is not considered to compromise the long term operational function of the tunnel. Further detail regarding residual risk is provided within para. 15.5.4 and in Vol 3 Section 15.

Tidal flood level modelling

15.3.13 The most extreme flood risk scenario that could affect the site would be the 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 event representing a specific likelihood of occurrence, in this case the 1 in 200 year (0.5% AEP) flood event.

15.3.14 The EA Thames Tidal Defences Joint Probability Extreme Water Level Study (2008)[8] 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.

15.3.15 Vol 23 Table 15.3.1 presents the modelled tidal levels from this study for years 2005 and 2107 at model node 2.42 .which is the most relevant (ie, closest) to the site. The location of model node in relation to the site is shown in Vol 23 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 amended future Thames Barrier closure rule (see Vol 2 Section 15) therefore the 2005 scenario (ie, the 'present day' scenario provided by the EA) produces the highest water level.

15.3.16 Vol 23 Table 15.3.1 also identifies that the existing defence levels at the site are above the 0.5% AEP tidal flood level. The site is therefore protected from tidal flooding to the statutory level.

[ii] Designated using a combination of consequence and distance from the defence as per the Defra publication 'Flood Risks to People'

Vol 23 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	

15.3.17 The Thames Embayment modelling has provided tidal flood levels for the Deptford Creek in the 1 in 200 year (0.5% AEP) and 1 in 1000 year (0.1% AEP) present day undefended scenario, with an operational Thames Barrier. The modelled tidal flood levels for the location on Deptford Creek closest to the Deptford Church Street site are shown in Vol 23 Table 15.3.2.

Vol 23 Table 15.3.2 Flood risk – Thames Embayment modelling water levels

Return period	Flood level (mAOD)	Statutory flood defence level (mAOD)
0.5% AEP(present day)	4.83	5.23
0.1% AEP (present day)	4.86	

15.3.18 Vol 23 Table 15.3.2 shows that the site is defended up to and above the 0.1% AEP event.

Tidal risk from the proposed development

15.3.19 Tidal flood risk from the proposed development would not increase flood risk elsewhere, as the development footprint would not impede flood flows or increase tidal levels, as a result of a breach or overtopping of the tidal defences.

15.3.20 As the site is partially located in Flood Zone 3a, the flood risk from this source is therefore considered to remain high.

Flood defence integrity

15.3.21 The tunnel excavation process using tunnel boring machines (TBMs) and other construction activities, has the potential to create differential settlement (that is a gradual downward movement of foundations due to compression of soil which can lead to damage if settlement is uneven), which could affect the level of some of the existing flood defences. In addition to that, the shaft construction process has also the potential to affect the flood defences at the site. The proposed Greenwich connection tunnel route runs from Greenwich Pumping Station to the main tunnel and would pass underneath the existing River Thames flood defence walls, which form the banks of Deptford Creek approximately 250m to the east of the site and therefore has the potential to affect the flood defences.

15.3.22 The proposed design has been informed by consideration of settlement and the alignment and methods used have been selected to minimise it as far as possible.

15.3.23 A potential settlement of up to 8mm is estimated to occur (based on information provided by Thames Water) at the defences along Deptford Creek, to the east of the Deptford Church Street site. As a result of this settlement, the flood defence levels following settlement are estimated to range from 5.64mAOD and 6.15mAOD and would therefore remain above the EAs statutory defence level (5.23mAOD).

Loss of volume from the tideway

15.3.24 The presence of temporary and permanent structures within the foreshore has the potential to reduce the availability of flood storage within the River Thames. The impact of the removal of flood storage on flood levels may propagate throughout the hydrological unit of the Thames reach and has been modelled on a project-wide basis.

15.3.25 The Deptford Church Street Site is not located on the banks of the tidal reaches of the River Thames (tidal Thames) but is still within the tidal influence of the River Thames at Deptford Creek. Therefore a consideration has been made regarding the implications of the project on water levels within the Tideway and the implications for flood defence freeboard at the Deptford Church Street Site.

15.3.26 The Deptford Church Street Site is located within the reach of Tower to Charlton in the tidal and fluvial modelling study. The modelling identifies that for this reach the potential maximum decrease in peak water level is 0.002m during the temporary works scenario reducing to 0.001m during the permanent scenario. The modelling also identifies a potential maximum increase of 0.014m in peak water level during the temporary works scenario reducing to 0.005m during the permanent scenario. As identified in para. 15.3.16 the flood defences at this site are above the statutory flood defence level and when compared to the 1 in 200 year tidal level for the year 2107 would provide 0.82-1.33m in freeboard. These predicted changes in water level and therefore freeboard are not considered to reduce flood protection at this site below design standard requirements and are therefore not deemed significant.

15.3.27 The results of the above modelling exercise show that the proposed project –wide works (both temporary and permanent works) are not considered to have a detrimental impact on the flood storage or tidal levels within the tidal Thames. This is discussed further in Vol 3 Section 15.

Fluvial flood risk to the proposed development

Level of risk based on the flood zones

15.3.28 This site is situated approximately 600m south from the River Thames. At this location, both fluvial and tidal inputs from the tidal Thames are component parts of the resulting water level. The results of flooding from the tidal influence of the River Thames are judged (see Vol 2 Section 15) to be of greater importance than those from fluvial influences. As the south-east part of the site is located within Flood Zone 3a, the fluvial flood risk associated with the tidal Thames is considered to be high (see Vol 2 Section 15).

15.3.29 The site is situated approximately 250m west of the tidal stretch of the Ravensbourne River (known as Deptford Creek). Paras. 15.3.31 to 15.3.34 outline the flood risk to the site from this source based on fluvial flood level modelling.

Fluvial flood defences

15.3.30 According to the information contained within the National Flood and Coastal Defence Database (EA, October 2012)[9] (NFCDD) the fluvial reach of the River Ravensbourne upstream of the Deptford Church Street site is defended to the 0.1% AEP standard as detailed in the following paras.

Fluvial flood level modelling

15.3.31 The EA provided flood levels derived from modelling on the fluvial extents of the River Ravensbourne. The tidal limit of the Deptford Creek ends at Deptford Bridge, where the Deptford Church Street and A2 (Blackheath Road) cross the river ie, upstream of the site.

15.3.32 The fluvial flood level relevant to the site (ie, at the closest modelling node approximately 300m to the south) is:

a. 4.89mAOD for the 1% AEP event, inclusive of climate change

b. 5.07mAOD for the 0.1% AEP event.

15.3.33 The fluvial defences relevant to the site have levels of 5.68mAOD or greater as indicated in the EA flood defence data5, and therefore protect the site up to and above a 0.1% AEP standard. This is also confirmed by the results of the flood mapping provided by the EA, which shows that the site is not inundated during either the 1% AEP inclusive of climate change event or the 0.1% AEP event. Therefore, as shown in Vol 23 Figure 15.3.2 (see separate volume of figures) the site is located in Flood Zone 1 associated with the River Ravensbourne.

15.3.34 The fluvial flood risk from the River Ravensbourne is therefore considered to be low.

Fluvial flood risk from the proposed development

15.3.35 The development is not located within the functional flood plain of the tidal Thames or the Deptford Creek, therefore the impact of the proposed development on the fluvial flood risk is not applicable for this site and is not assessed further.

Surface water flood risk to the proposed development

15.3.36 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.

15.3.37 As part of the Drain London Project[iii], a *Surface Water Management Plan* (*SWMP*) was developed for the LB of Lewisham (Greater London Authority, July 2011)[10]. This identifies the Deptford Church Street site is not located within a Critical Drainage Area[iv] (CDA), which suggests that the site is relatively less susceptible to surface water flooding than other local areas. Modelling results for a 1 in 100 year (1% AEP) rainfall event plus climate change allowance in the Lewisham *SWMP* show potential surface water flooding of up to 0.5m deep in small sections of the site.

15.3.38 The main site area has an approximate ground level 6mAOD. The ground level of the site is slightly raised above the roads that border the site (ie, Coffey Street, Deptford Church Street and Crossfield Street). As such, surface water runoff would remain in the channel of the roads and would not be likely to affect the site.

15.3.39 As the potential flood depths shown on the site are up to 0.5m flood risk to the site from this source of flooding is considered to be medium (see Vol 2 Section 15).

Surface water flood risk from the proposed development

15.3.40 An assessment of the likely significant effects of surface water from the Deptford Church Street site is provided in Section 14 of this volume.

15.3.41 The Waste Water 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. In accordance with the Waste Water NPS, runoff rates following the proposed development should not be greater than the existing (pre-development) rates.

15.3.42 The majority of the proposed development site is primarily an undeveloped greenfield area with no known site drainage network. Surface water is thought to infiltrate directly into the ground within the greenfield area.

15.3.43 It is estimated that post development, the total impermeable area of Deptford Church Street site would increase by approximately 0.05ha.

15.3.44 In order to comply with the Waste Water NPS and Mayor's essential standards, surface water runoff from the new development would be attenuated on site to the existing greenfield runoff rate before being discharged to the local sewer network. Based on the above estimate of increase in impermeable area, the required surface water attenuation volume is estimated to be approximately between 25 m^3 and 35m^3 for a 1% AEP plus climate change rainfall event.

15.3.45 A brown roof is proposed on the electrical kiosk, 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

[iii] A London wide strategic surface water management study undertaken by the GLA and London Councils

[iv] An area susceptible to surface water flooding.

instance the use of bark chipping, permeable pathways and storage cells under the permeable pathways.

15.3.46 If required, on site underground storage would also be provided in combination with SuDS measures in order to meet the necessary attenuation requirements and achieve greenfield runoff rates.

15.3.47 Therefore following the implementation of above drainage measures, the risk of surface water flooding as a result of the proposed development is considered to be unchanged and would remain as medium.

Groundwater flood risk to the proposed development

15.3.48 Groundwater flooding occurs where groundwater levels rise above ground surface levels.

15.3.49 The upper aquifer at this site is within the river terrace deposits. The lower aquifer is within the Upnor Formation, Thanet Sands and Seaford Chalk. Groundwater levels have been recorded in boreholes located approximately 400m from the site. For the purposes of flood risk, the water levels of the upper aquifer are most relevant. Water levels in the river terrace deposits have been recorded by Thames Water at a borehole PR1023(U). At this location the water levels of the upper aquifer (ie, in the river terrace deposits) are on average approximately 3m below ground level (bgl). These are noted to be below the top of the formation, indicating the river terrace deposits are unconfined and not fully saturated at this location.

15.3.50 The upper aquifer is unconfined at this site and therefore could potentially rise to the ground surface. There is expected to be hydraulic continuity between the upper and lower aquifers. However, given the depth of the groundwater the flood risk is considered to be low (see Vol 2 Section 15).

Groundwater flood risk from the proposed development

15.3.51 An assessment of the likely effects on groundwater at the Deptford Church Street site is provided in Section 13 of this volume.

15.3.52 The CSO drop shaft would pass through made ground, river terrace deposits, Lambeth Group (Upper Formation), Thanet Sands and Seaford Chalk. Internal dewatering is anticipated during the construction phase to manage the water levels within the site 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.

15.3.53 The presence of the CSO drop shaft creating a physical barrier has been assessed as having a predicted rise in water levels (0.19m during construction and less than 0.1m during operation). This is considered to be a negligible impact on the water levels of the upper aquifer, and therefore there is no increase in the risk from groundwater flooding to the site as a result of the development.

15.3.54 Following the construction of the proposed development the risk of flooding from this source would be unchanged and therefore remain medium.

Sewers flood risk to the proposed development

15.3.55 Sewer flooding arises when the local sewer network is exceeded or a problem arises such as a blockage or fracture.

15.3.56 The Deptford Storm Relief Sewer (4115 x 3353mm) runs northwards along Deptford Church Street to the east of the site. This outfalls to the tidal Thames to the north of Deptford Green. The capacity of the Deptford Storm Relief Sewer is unlikely to be exceeded as it is designed to discharge via the outfall. However, high river levels could restrict discharges from the Deptford Storm Relief outfall causing sewage to back up in the system.

15.3.57 A surface water sewer runs west along Coffey Street and connects to the Crossfield Street combined sewer (305mm diameter). Surface water sewers also run along Deptford Church Street to the east of the site and Crossfield Street to the south. A number of small (<250mm diameter) combined sewers connect to the Crossfield Street sewer. This connects into the 914 x 762mm Deptford Church Street Sewer, North Section, which flows in a southerly direction along Deptford Church Street.

15.3.58 The Bronze Street combined sewer runs westward along Bronze Street into the Deptford Church Street Sewer, North Section, as does an unnamed 305mm diameter combined sewer to the south.

15.3.59 Combined sewers run westward along Mary Anne Buildings and Albury Street north of the Deptford Church Street site and connect to the Low Level Sewer No. 1, (1676mm diameter) which runs from north to south along Deptford High Street approximately 50m west of the site before turning eastward 50m south of the site.

15.3.60 Should the capacity of the local sewers be exceeded, sewage could surcharge through gullies and manholes along the reach of the sewers. Manholes are present along all of the above sewers in proximity to the site, with the exception of the Deptford Storm Relief Sewer and Deptford Church Street sewer. The local topography suggests that any sewage from Bronze Street would follow the path of Bronze Street to Deptford Church Street, where it would run in a southerly direction following the channel of the road. Any sewage in the south-eastern section of Crossfield Street could flow along Crossfield Street towards Deptford Church Street.

15.3.61 Thames Water flooding records (Thames Water, June 2012)[11] show that there has been 1 record of sewer flooding within 200m of the site since 1990.

15.3.62 Although there is a low incidence of sewer flooding in the area, numerous combined sewers border the site, therefore the flood risk from this source is considered to be medium (see Vol 2 Section 15).

Sewers flood risk from the proposed development

15.3.63 It is proposed that the Deptford Storm Relief Sewer would be intercepted to the east of the site and connected to the Greenwich connection tunnel which would direct flows into the main tunnel. The connection between the Bronze Street combined sewer and the Deptford Church Street combined sewer would be maintained through works within the interception chamber.

15.3.64 At present, high water levels in the tidal Thames can restrict the outfall of the Deptford Storm Relief Sewer. Following construction, there would only be a restriction on sewage flows entering the main tunnel should the tunnel become full or unavailable or in the event of the system experiencing a storm event with a return period exceeding design. In this situation, flows would discharge to the tidal Thames through the existing outfall.

15.3.65 Following the construction of the proposed development the risk of flooding from this source would be unchanged and therefore remain medium.

Artificial sources flood risk to and from the proposed development

15.3.66 There are no nearby artificial flood sources eg, canals, reservoirs, which could lead to flooding of the site.

15.3.67 The flood risk from this source both to and from the proposed development is not applicable at this site and therefore it has not been assessed further.

15.4 Design measures

15.4.1 Measures have been incorporated into the design of the proposed development to ensure the risk of flooding to and from the site and surrounding areas are 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

Flood defences

15.4.2 As discussed in para. 15.3.21 the proposed Greenwich connection tunnel alignment passes beneath the Thames Tidal Defences which run along the banks of Deptford Creek, approximately 250m to the east of the Deptford Church Street site and has the potential to affect the integrity of the defences.

15.4.3 During construction defence assets, which are considered to be at risk of settlement, would be monitored, and where required repairs would be made in agreement with the asset owner and the EA to ensure crest

heights of the flood defences are maintained to the existing level. With this strategy in place, no effects of settlement are anticipated.

Emergency plan

15.4.4 Appropriate emergency planning procedures would be adopted by the contractor during the construction phase to mitigate the potential consequences in the event of a breach in the flood defence wall or a failure of the Thames Barrier. Further information is included within the *CoCP* (Section 8).

Operation

Emergency plan

15.4.5 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

15.4.6 In accordance with the *CoCP* (Section 8) all site drainage during construction would be drained and discharged to mains foul or combined sewers and 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 combined or surface water drains. Foul drainage from the site welfare facilities would be connected to the mains foul or combined sewer. These design measures 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

15.4.7 Surface water runoff would be restricted to the greenfield runoff rates by a potential suite of measures including a brown roof, permeable paving and underground storage prior of being discharged into the drainage network.

Groundwater

15.4.8 Groundwater monitoring is proposed during construction and operation. Groundwater resulting from dewatering during construction would be pumped to the combined sewer network. Further details on design measures pertaining to dewatering and maintaining groundwater levels are described in Section 13 of this volume.

Sewers

Construction

15.4.9 The Deptford Church Street Sewer, North Section, located under the Deptford Storm Relief Sewer would be protected. As well as the interception of the Deptford Storm Relief sewer, the connection between

the Bronze Street combined sewer and the Deptford Church Street combined sewer would be maintained through works within the interception chamber. The operation of the Deptford Church Storm Relief Sewer would be maintained during the construction period.

Operation

15.4.10 Following construction, the Deptford Storm Relief Sewer would be intercepted to the east of the site and connected to the Greenwich connection tunnel which would direct flows into the main tunnel.

15.4.11 Should the tunnel become full or unavailable or in the event of the system experiencing a storm event with a return period exceeding design, sewage flows would be diverted to the tidal Thames via the Deptford Storm Relief Sewer, ensuring no increase in flood risk compared to the existing scenario.

15.5 Assessment summary

Flood risk

15.5.1 The Deptford Church Street site is partially located within the EA Flood Zone 3a associated with the tidal influence of River Thames in Deptford Creek and is protected from both fluvial and tidal flooding up to and above the 0.1% AEP event. Potential settlement as a result of the tunnelling works is not estimated to cause the flood defences to fall below the EAs statutory flood defence level.

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.

15.5.3 Vol 23 Table 15.5.1 provides a summary of the findings of the FRA undertaken for this site.

Residual risk to the development

15.5.4 The residual risk to the site is the risk that remains after all design measures have been incorporated.

15.5.5 The site would be at residual risk of tidal and fluvial flooding in the event of a breach in the flood defence wall or overtopping of the defence wall as a result of a failure of the Thames Barrier.

15.5.6 It is considered that the consequence of a breach or failure of flood defences 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 Section 15.

Residual risk from the development

15.5.7 Following the incorporation of the design measures outlined in Vol 23 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 Section 15.

Vol 23 Table 15.5.1 Flood risk – level 2 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 tidal Thames flood defences	High* (but residual only)	Flood Defence height maintained. Monitoring of flood defence levels and repaired as required to maintain existing crest level.	No increase in tidal flood risk as a result of proposed development.	High (but residual only)
Fluvial	Breach/ overtopping of tidal Thames flood defences	High (but residual only)	Flood Defence height maintained. Monitoring of flood defence levels and repaired as required to maintain existing crest level.	No increase in fluvial flood risk as a result of proposed development.	High (but residual only)
	(River Ravensbourne)	Low	None required	No increase in fluvial flood risk as a result of proposed development.	Low
Surface water	Surrounding area	Medium	Discharge surface water to drainage network. Additional surface water flood risk from the site managed through SuDS.	No increase in surface water flood risk as a result of proposed development.	Medium
Groundwater	Underlying geology and groundwater levels restricted pathway	Low	Internal dewatering during construction. Monitoring proposed during construction and operation.	No increase in groundwater flood risk as a result of proposed development.	Low

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	Medium	Storm Relief Sewer maintained during construction. Protection provided to sewers in proximity of works.	No increase in sewers flood risk as a result of proposed development	Medium
Artificial sources	None	Not applicable	Not applicable	Not applicable	Not applicable

** Definitions of these classifications are included in Vol 2 Section 15*
() 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] Communities and Local Government. *National Planning Policy Framework* (March, 2012).

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[4] Environment Agency. *National Flood and Coastal Defence Database* (October, 2011).

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[6] JBA. *London Borough of Lewisham Level 1 Strategic Flood Risk Assessment* (July 2008).

[7] Defra and Environment Agency. Flood Risk to People, The Flood Risk to People Methodology (FD2321/TR1) (March 2006).

[8] Environment Agency. *Thames Tidal Defences Joint Probability Extreme Water Levels 2008 Final Modelling Report.* (April 2008).

[9] Environment Agency. *National Flood and Coastal Defence Database* (October, 2011).

[10] Greater London Authority. *London Borough of Lewisham Surface Water Management Plan Final Report* (July 2011).

[11] Thames Water. *Sewer Flooding Records* (received June 2012).

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