Thames Tideway Tunnel
Thames Water Utilities Limited

Thames Water

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
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Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

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

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling Street site assessment

Errata

Section	Paragraph No.	Page No.	Errata / Clarification
Section 9 Noise and vibration	9.7.2(b)	34	Text should read “Elm Quay would be subject to noise from the development at Embassy Gardens.”
Section 9 Noise and vibration	9.7.4	34	Text should read “Elm Quay does not have a significant effect identified as a result of works at the Kirtling Street site or the Heathwall Pumping Station site. The construction of Embassy Gardens could lead to significant effects but a cumulative effect is not identified for this receptor”.

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Application for Development Consent

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Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

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 Kirtling Street site.

1.1.2 The proposal at this site is to drive the tunnel boring machine from this site to Carnwath Road Riverside to the west and drive a separate tunnel boring machine concurrently to Chambers Wharf to the east. There would be no combined sewer overflow (CSO) interception at this site.

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 (Vol 14 Kirtling Street figures volume and Vol 14 Kirtling 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 in the London Borough (LB) of Wandsworth on the southern bank of the River Thames. It is proposed to use the site as a main tunnel double drive site. There is no CSO interception at this site.

2.1.2 The site extent is defined by the limits of land to be acquired or used (LLAU) covering an area of approximately 5.2 hectares. The site context and location is indicated in Vol 14 Figure 2.1.1 (see separate volume of figures).

2.1.3 The site comprises four areas of land as well as an area extending into the River Thames. The southern area of the site is bounded by Kirtling Street, Cringle Street and Nine Elms Lane and contains industrial premises and offices including the former Cable and Wireless building. Immediately north is a former depot, bounded by Cringle Street to the south and Kirtling Street to the west, north and east. North again is a depository used by the Victoria and Albert Museum which fronts onto the River Thames. Immediately west and extending south as far as Cringle Street is a concrete batching plant, occupied by Cemex. The batching plant includes a jetty at the safeguarded Kirtling Wharf (also known as Cringle Wharf) which falls within the riverward portion of the proposed development site. The plant has permission to operate on a 24 hour basis.

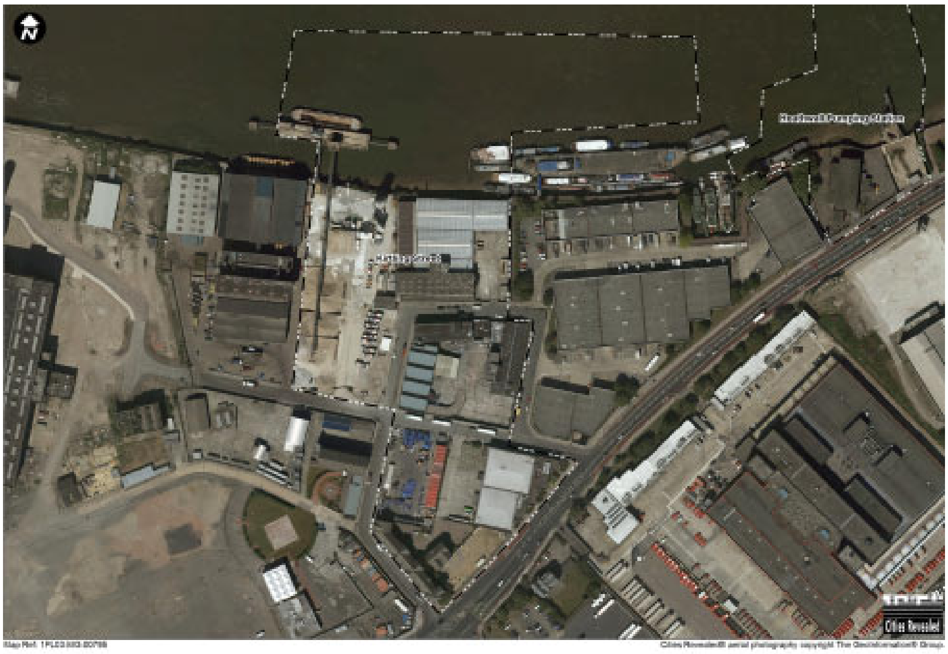
2.1.4 Beyond the site to the east is the Tideway Walk (Riverlight) development, currently under construction. Hoarding has been erected around this site and construction has commenced for this residential-led mixed used development. Nine Elms Pier, which has residential moorings, is to the north of the Riverlight development and to the east of the Kirtling Street site. Several the residential moorings fall within the LLAU for the Kirtling Street site.

2.1.5 To the west of the Kirtling Street site and on the northern side of Cringle Street is Cringle Dock waste transfer station which fronts onto the River Thames. On the southern side of Cringle Street is the Thames Water ring main pumping station. Further west is the Grade II* Battersea Power Station, which was decommissioned in the early 1980s. Battersea Park Road and Kirtling Street form the southern boundary of the site.

2.1.6 Vol 14 Plate 2.1.1 provides an aerial view of the site and surrounding area.

2.1.7 The area further south contains industrial premises and offices including the Brooks Court and an electricity substation. The general pattern of existing land uses within and around the site is shown in Vol 14 Figure 2.1.2 (see separate volume of figures).

Vol 14 Plate 2.1.1 Kirtling Street – aerial photograph



2.1.8 Existing access to the site is from Nine Elms Lane, Battersea Park Road via Cringle Street, and Kirtling Street (see Vol 14 Plate 2.1.3). The closest railway station is Vauxhall station approximately 1.1km walking distance to the northeast. The Thames Path public right of way (PRoW) runs from the river bank along the northeast edge of the site, through the site along Kirtling Street then crosses Cringle Street, and runs down into Nine Elms Lane. Photographs of the area are provided in Vol 14 Plate 2.1.2 and Vol 14 Plate 2.1.4.

Vol 14 Plate 2.1.2 Kirtling Street – view looking south-west towards concrete batching plant

Vol 14 Plate 2.1.3 Kirtling Street – access from Kirtling Street/Cringle Street

Vol 14 Plate 2.1.4 Kirtling Street – foreshore

2.1.9 There are a number of receptors in close proximity to the site and these include residential, educational, commercial and recreational receptors as follows:

a. residential

   i Nine Elms Pier house boats to the east of the site and located within the LLAU.

b. educational

i There are no education establishments within 250m of the site hoarding

c. commercial

i Cemex concrete batching works within site.

ii Cringle Dock Waste Transfer Station and civic amenity site adjacent

d. recreational

i River Thames within and adjacent to the site

ii Thames Path public right of way runs through the site.

2.1.10 Environmental designations for the site and immediate surrounds are shown in Vol 14 Figure 2.1.3 (see separate volume of figures).

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

2.1.12 The foreshore area at the site falls within the River Thames and Tidal Tributaries Site of Importance for Nature Conservation (SINC) (Metropolitan level). Battersea Power Station SINC (Borough level) is located immediately to the west of Kirtling Street and south of Cringle Street.

2.1.13 There are no listed buildings within the site. The Grade II listed Battersea Pumping Station, and the Grade II* Battersea Power Station which was decommissioned in the early 1980s, are located to the west of the site.

2.1.14 The site does not lie within and is not adjacent to a conservation area. A large section of the site falls within the Wandsworth Archaeological Priority Area.

2.1.15 There are no tree preservation orders (TPOs) in effect within or adjacent to the site. There are a small number of trees within the southern part of the site occupied by the Brooks Court office buildings.

2.1.16 There is potential for contamination of the site to have occurred in the past from uses as a paint and colours works, a depot, a warehouse, and a garage and associated fuel filling station. There is also potential for contamination to have occurred from the land’s current use as a concrete batching works.

2.1.17 The geology of the site is made up of made ground, alluvium, river terrace deposits, London clay, Lambeth group and Thanet sand.

2.1.18 Part of the site is located within the River Thames foreshore and as such it is classified as functional floodplain (Flood Zone 3b, where water must flow or be stored in times of need). The inland part of the site is located behind the River Thames flood defences within Flood Zone 3a (1 in 100 event).

2.1.19 The limits of land to be acquired or used for Thames Tideway Tunnel project Heathwall Pumping Station site to the east are almost adjacent to the Kirtling Street site as seen in Vol 14 Plate 2.1.1.

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Volume 14: Kirtling Street site assessment

Section 3: Proposed development

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3 Proposed development

3.1 Overview

3.1.1 The proposed development at Kirtling Street comprises a main tunnel double drive site, with tunnelling to Carnwath Road Riverside to the west Chambers Wharf to the east. There would be no CSO interception at this site. A shaft would be constructed, and a tunnel boring machine would be launched through the base of the shaft west to Carnwath Road Riverside, and another tunnel boring machine launched east to Chambers Wharf.

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

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

3.1.4 Other developments may become operational in advance of or during the Thames Tideway Tunnel project thereby changing the baseline conditions. In order to undertake an accurate assessment it is necessary to compare the predicted situation with the Thames Tideway Tunnel project in place with this future baseline ('base case') (rather than comparing it with the current conditions). In addition, other developments may be under construction at the same time as construction or operation of the Thames Tideway Tunnel project and this could lead to cumulative effects. Information regarding schemes included in the base case and in the cumulative assessment is presented in Section 3.5 with details included in Vol 14 Appendix N. The methodology for identifying these schemes is explained in Volume 2 Section 3.8. Finally, Section 3.6 describes how the development at this site has evolved and any 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 14 Table 3.2.1 lists below the plans and documents for which consent is sought and which have been assessed.

Vol 14 Table 3.2.1 Kirtling 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 14 Kirtling Street figures – Section 1
Demolition and site clearance plan	For approval	Vol 14 Kirtling Street figures – Section 1
Access plan	For approval	Vol 14 Kirtling Street figures – Section 1
Proposed landscape plan	Indicative	Vol 14 Kirtling Street figures – Section 1
Kiosk and ventilation column design intent	Indicative	Vol 14 Kirtling Street figures – Section 1
Design Principles: Generic	For approval	*Design Principles* report Section 3 (see Vol 1 Appendix B)
Design Principles: site-specific principles (Kirtling Street)	For approval	*Design Principles* report Section 4.11 (see Vol 1 Appendix B)
Code of Construction Practice Part A: General Requirements	For approval	Vol 1 Appendix B
Code of Construction Practice Part B: Site-specific Requirements (Kirtling Street)	For approval	Vol 1 Appendix B

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

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

a. **Work No. 13a:** Kirtling Street main tunnel shaft – A shaft with an internal diameter of 30 metres and a depth (to invert level) of 48 metres

Associated development

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

a. **Work No. 13b**: Kirtling Street associated development - Works to establish a main tunnel drive site for use in constructing, connecting and operating the main tunnel (west central) (Work No. 1b) and main tunnel (east central) (Work No. 1c), including the following above and below ground works and structures:

   i demolition of existing office and warehouse buildings, to the north of Kirtling Street, to the north and south of Cringle Street and demolition of structures within Kirtling Wharf (also known as Cringle Wharf) including existing concrete batching plant, offices and electricity sub-station and ground preparation works including land remediation

   ii provision of a [permanent] concrete batching plant including aggregate storage, silos, concrete plant, tanks, pits, offices and electricity substation Kirtling Wharf;

   iii dredging and construction of temporary jetty including conveyors with acoustic enclosures and works to protect the existing river wall

   iv provision of areas for [assembly of plant and machinery], storage of construction materials and excavated materials including temporary enclosures and workshops, concrete batching plant, fixed and mobile craneage, plant and equipment for ground treatment and dewatering and facilities and equipment for the processing of excavated materials from shaft and tunnel excavation including silos, tanks and conveyors (with and without noise enclosures), provision of power supplies (including substations), and other utilities including temporary buildings and other means of enclosure, office and welfare facilities and installations and equipment for monitoring the construction activity

v construction of an acoustic enclosure building(s) over Work No. 13a for use in association with the construction of Work Nos. 1b and 1c

vi construction of structures for air management plant and equipment including filters and ventilation columns and associated below ground ducts and chambers

vii construction of electrical and control kiosks

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

ix provision of construction accesses off Cringle Street and subsequent reinstatement of original highway layout

x provision of a permanent access off Kirtling Street.

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

a. Combined ventilation column and electrical and control kiosk −6m (with minimum 4.0m)

b. For the relocated concrete batching plant:

i Water tanks and wedge pit – 10m

ii Aggregate storage bins, cement silos, concrete plant, water tanks, wedge pit, conveyor, blowing shed and hopper – 30m

iii Tanks, bays and substation – 5m

iv Offices, welfare and blowing shed – 5m

3.2.4 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

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

Ancillary works

3.2.6 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*.

3.2.7 The following ancillary works are set out in Schedule 1 of the *Draft DCO*:

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

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

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

d. installation of pumps in chambers and buildings

e. works to trees and landscaping works not comprising development

f. works associated with monitoring of buildings and structures

g. provision of construction traffic signage

h. the relocation of boats/vessels

Design principles

3.2.8 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).

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

3.2.10 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.

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

Site features and landscaping

3.2.12 Upon completion of the works, the proposed landscaping plan shows the retention of the concrete batching works. The relocation of the existing plant to a smaller area towards the southern part of the site would take place at the start of construction and would remain in the permanent layout.

3.2.13 The Site works parameter plan (see separate volume of figures – Volume 1) sets out the zones within which the permanently relocated concrete batching plant would be sited. This includes structures of up to 30m in height. This arrangement ensures that access is available to the shaft.

3.2.14 An electrical and control kiosk combined with a ventilation column of between 4m and 6m height would be located within a defined zone located towards the western boundary of the site of Kirtling Wharf. An alternative location is also identified toward the eastern side of Kirtling Wharf. Based on the Kiosk and ventilation column design intent plan (see separate volume of figures – Section 1), this would be finished in high quality concrete and would include a brown roof.

3.2.15 Tree planting is proposed along the western side of Kirtling Street adjacent to the concrete batching plant site. An area of hardstanding would be provided to enable access into the shaft and tunnel for inspection and maintenance purposes. There would be high quality secure hoarding for those parts of the site that are not public highway.

Code of Construction Practice

3.2.16 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.

3.2.17 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* at Kirtling 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 a description of typical construction activities.

3.3.4 It is also assumed that, where the appropriate powers do not form part of the Development Consent Order, further consents may be required before certain construction activities are progressed. These could include various consents issued by the 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 The main works at this site would be likely to commence in 2016 (Site Year 1). Construction would be completed by 2022 (Site Year 6). The infrastructure at the site would only become operational in 2023 when the Thames Tideway Tunnel project as a whole becomes operational.

3.3.6 Construction at the Kirtling Street site is anticipated to take approximately six years and would involve the following phases (with some overlaps):

a. Site Years 1 – Site setup (approximately seven months)

b. Site Years 1 to 2 - Shaft construction (approximately 15 months)

c. Site Years 2 to 4 - Tunnelling (approximately 26 months)

d. Site Years 4 to 5 – Secondary lining (approximately 11 months)

e. Site Years 5 to 6 – Construction of other structures (approximately eight months)

f. Site Years 6 – Completion of works and site restoration (approximately five months).

3.3.7 This site would operate to the standard, extended and continuous 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 shaft construction, tunnelling and secondary lining as described below.

3.3.8 It is assumed that extended hours would be required for approximately twice a week during diaphragm walling for a total duration of approximately three months, and once a month during other major concrete pours. Extended working hours are required at this site to allow for major concrete pours for shaft construction including diaphragm wall panels, base slab, roof slab and other large elements. The exact timing of any extended hours of working would be consulted on, and notified to the London Borough of Wandsworth.

3.3.9 Continuous hours would be required during tunnelling for a duration of approximately 26 months, and during secondary lining of the tunnel for a duration of approximately 11 months but these activities are generally underground. It is noted that there would be periods of activity within this phase where continuous 24 hour working would not be required including TBM assembly, maintenance and dismantling.

3.3.10 During these periods only those activities directly connected with the task would be permitted within the varied hours.

Typical construction activities

3.3.11 Vol 14 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 key construction phases and relevant activities.

Vol 14 Table 3.3.1 Kirtling Street site - construction phase plans

Plan title	Activities	Status	Location
Construction phase 1 plan	Site setup	Illustrative	Vol 14 Kirtling Street figures – Section 1
Construction phase 2 plan	Shaft construction Tunnelling	Illustrative	Vol 14 Kirtling Street figures – Section 1
Construction phase 3 plan	Secondary lining Construction of other structures Completion of works and site restoration	Illustrative	Vol 14 Kirtling Street figures – Section 1
Construction phase 4 plan	Site demobilisation	Illustrative	Vol 14 Kirtling Street figures – Section 1

3.3.12 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.

3.3.13 The following construction activities are described:

a. site setup
b. shaft construction
c. tunnel construction
d. tunnel and 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

3.3.14 Prior to any works commencing the site boundary would be established and secured with hoarding as appropriate. The boundary would be built to the height specified in the *CoCP*. Welfare and office facilities would also be set up.

3.3.15 Traffic management and access works would be undertaken as appropriate.

3.3.16 The extent of demolition and site clearance works are shown on the Demolition and site clearance drawing (see separate volume of figures – Section 1).

3.3.17 Power and water supplies would be required on site, and utility diversions would be undertaken as necessary. This includes the construction of a temporary substation.

3.3.18 Due to the space requirements of the double drive site, a significant level of demolition and site clearance would be required. All above ground structures, including an industrial warehouse, depot, and office buildings would require demolition. The existing concrete batching plant would be located on a smaller area towards the southern section of the existing plant. The conveyor would be reconfigured to allow movement of material from the jetty to the aggregate storage bins, which would be up to 30m in height. The substation for the batching plant would require relocation as part of the utility diversions and connection process. The remaining substation would remain in place and be protected. The concrete batching plant, which is a 24 hour facility, would remain in use throughout the construction phase.

3.3.19 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 (within Site Year 1) and that any associated lorry movements are substantially lower than the subsequent peak during the main construction phases.

3.3.20 A jetty would be constructed, sufficient to house two conveyors and to serve up to three barges. Dredging would be required to provide sufficient underkeel clearance to moored barges. The existing concrete batching plant would be reconfigured to the southern part of the safeguarded wharf, and houseboats would be relocated if required.

Shaft construction

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

3.3.22 The main tunnel shaft would be constructed by diaphragm wall construction techniques and have a cast in situ secondary lining. The diaphragm wall would support the excavation through the water bearing Terrace Gravel and Lambeth Group geological layer. The diaphragm walls would extend below the shaft base into the Thanet sands.

3.3.23 The first stage in the construction of each panel of diaphragm wall would be the excavation and setting of inner and outer guide walls. These guide walls would provide secure supports between which excavation for the diaphragm walls would be undertaken. During excavation the trench is filled with bentonite for ground support; on completion of excavation cycle, steel bar reinforcement cages are lowered in before concrete is pumped into the wall and the bentonite displaced. This process is repeated for each diaphragm wall panel which creates the full circle of the shaft. Diaphragm wall excavated material would be processed as required and then loaded onto a lorry for transport off site.

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

3.3.25 The 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 exposing the walls. The excavator within the shaft would load shaft skips, hoisted by crawler crane, depositing the excavated material within the handling area. Excavated material would be put into skips within the shaft working area and hoisted by crawler crane from the shaft and deposited in a suitable storage area. After any required treatment, the material would be loaded onto a lorry for transport off site.

3.3.26 A steel reinforced concrete base plug would be formed at the base of the shaft.

3.3.27 It is anticipated that dewatering of the Lambeth Group would be required. Dewatering wells would be drilled from the surface on the periphery of the shaft (a process known as 'external dewatering') and groundwater extracted via pumps. These pumps would be operational during shaft excavation. For the purpose of this assessment it has been assumed that the pumps would be maintained for launching the TBM drives to Carnwath Road Riverside and Chambers Wharf. It is assumed that extracted ground water would be discharged directly into the River Thames after being treated through a settlement system. Extracted water would be sampled on a regular basis to check water quality.

3.3.28 It is anticipated that ground treatment may be required within the Lambeth Group to facilitate the TBM breakout of the shaft.

Tunnelling

3.3.29 Approximately 7.7km of 7.2m internal diameter tunnel would be driven east to Chambers Wharf and 5km west to Carnwath Road Riverside by an earth pressure balance (EPB) TBM.

3.3.30 The easterly and westerly tunnels would be constructed concurrently but, due to the confines of the shaft, the TBMs would be launched sequentially. To enable the timely launch of the TBMs a sprayed concrete lined chamber could be constructed.

3.3.31 The first TBM (to Chambers Wharf) would mainly drive through Lambeth Group geology and enter the Thanet Sands and Seaford Chalk towards the end of its drive at Chambers Wharf. The second TBM to Carnwath Road Riverside would mainly drive through London Clay.

3.3.32 The tunnel drive to Chambers Wharf would pass through the proposed shaft at the Blackfriars Bridge Foreshore site. This would allow access to inspect and maintain the TBM.

3.3.33 On completion of the shaft construction, the site layout would be reconfigured to support the tunnelling works. The reconfigured layout would include:

a. excavated material storage areas including conveyors

b. precast concrete tunnel lining storage areas including gantry cranes

c. materials laydown areas for pipes, ventilation ducting, temporary tunnel railway track, power cable drums and other TBM consumables

d. an acoustic enclosure over the shaft and gantry crane area to reduce potential noise impacts (erected after TBM assembly)

e. workshops/stores

f. grout batching plant.

3.3.34 The TBM sections would be delivered to site by road and assembled within the shaft serviced by large mobile or crawler cranes.

3.3.35 Tunnel portals would be formed in the shaft lining. The portals would consist of cast in-situ reinforced concrete. After TBM assembly and launch but prior to the start of tunnelling works, the enclosure would be installed over the shaft area to mitigate for potential noise effects.

3.3.36 Once launched the TBM would cut the ground by rotating the cutter head whilst hydraulic shove rams would propel it forward. Precast concrete segmental tunnel linings would be installed as the TBM progresses. The excavated material would be transported by conveyor to the surface. The TBM would move forward and a temporary railway built behind it within the tunnel as the TBM proceeds to bring material to the TBM including precast concrete segments.

3.3.37 Excavated material would be transported to awaiting barges via the temporary jetty (or to temporary stockpile if the barge is unavailable) for onward disposal offsite. The TBMs would be received into Carnwath Road Riverside and Chambers Wharf shafts where they would be dismantled. Large mobile cranes would be used to raise the TBM sections from the shaft for removal offsite by road.

Secondary lining of tunnel and shaft

3.3.38 Secondary lining is an additional layer of concrete placed against the inside of a tunnel’s primary concrete segmental lining for water tightness and to improve the overall structural durability. For the purposes of assessment, it has been assumed that all tunnels would have reinforced concrete secondary linings.

3.3.39 It has been assumed that on completion of the tunnelling phase, a batching plant would be mobilised to site. The plant would supply the secondary lining of the main tunnel. Concrete would be batched on surface and pumped or skipped to the tunnel. The underground railway would be used to transport the concrete and reinforcement to the area of the pour. The tunnel enclosure installed over the main tunnel shaft and gantry crane area during tunnelling would remain in situ during secondary lining.

3.3.40 The secondary lining of the main tunnel would be constructed by installing steel reinforcement, erecting a cylindrical shutter within a short length of tunnel and pumping concrete into the gap between the shutter and the primary lining. Once the concrete has hardened sufficiently, the shutters would be removed and erected in the next section of tunnel.

3.3.41 It is assumed that the lining of the main tunnel 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 shaft and sections of reinforcement installed and lining cast progressively up the shaft.

3.3.42 Any reinforced concrete structures internal to the main tunnel shaft and 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

3.3.43 Air management structures comprising underground chambers, ducts, and an integrated electrical and control kiosk and ventilation column would be constructed on the site.

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

3.3.45 The walls, bases and roofs of the chambers and shallow foundations for above ground structures would be formed by in-situ concrete techniques. Concrete would be pumped or skipped to the chamber.

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

Completion of works and site restoration

3.3.47 The temporary conveyors and jetty would be dismantled and removed.

3.3.48 On completion of the construction works the permanent works area would be finished in accordance with the landscaping requirements.

3.3.49 The Thames Path would be reinstated along its existing alignment.

Excavated materials and waste

3.3.50 The construction activities described above and in particular the construction of the main tunnel shaft and the subsequent tunnelling would generate a large volume of excavated material which would require removal. This is estimated at 1,644,500 tonnes, the main elements of which would comprise 16,000 tonnes of mixed materials from the diaphragm wall construction, 813,500 tonnes of Lambeth group, 698,000 tonnes of London Clay, 76,000 tonnes of Thanet sands and 15,000 tonnes of made ground.

3.3.51 In addition, it is estimated that approximately 5,700 tonnes of construction waste would be generated including 3,330 tonnes of concrete.

3.3.52 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

3.3.53 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’ or a ‘barge’.

3.3.54 The transport strategy specifies that the removal of tunnel excavated material would be by barge and tunnel secondary lining aggregates would be brought to site by barge. For assessment purposes it is assumed that 90% of these materials would be taken by river and the remaining 10% by road. This allows for periods where river transport is unavailable and to take into account material unsuitable for river transport,

3.3.55 The highest barge movements would occur during main tunnel construction. Peak daily barge numbers, averaged over a one month period, would be four barges per day, equivalent to eight barge movements. It is estimated that total barge numbers for this site would be 1,620, equivalent to 3,240 barge movements.

3.3.56 Barge numbers are based upon an assessed barge size of 1000T.

3.3.57 The tug dwell time for this site is assessed as being 25 minutes to deliver and collect barges.

3.3.58 Peak vehicle movements would be associated with specific site activities. The highest lorry movements at the site would occur during main tunnel construction. The peak daily vehicle numbers at this time, averaged over a one month period, would be 96 HGV lorries, equivalent to 192 movements per day. It is estimated that total vehicle numbers for this site would be in the order of 51,500 HGV lorries, equivalent to 103,000 movements.

3.3.59 The construction area is split over two sites separated by Cringle Street. The northern site would be accessed via three new site entrances. One at either end of the closed northern section of Kirtling Street, incorporating the current road layout and kerb alignment, and the third would be newly constructed on Cringle Street requiring the kerb to be dropped.

3.3.60 The southern site would be accessed through an existing gate on Cringle Street and would not require additional alignment or kerb modifications.

3.3.61 A one-way access system would be implemented for construction traffic via Kirtling Street with the western section used as the access and the eastern section used as the egress route. Similarly, Cringle Street would be accessed via the western end and egressed through the eastern section towards Nine Elms Lane.

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

3.3.63 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 operational the project would divert the majority of current CSO discharges to the main tunnel and then via the Lee Tunnel for treatment at Beckton Sewage Treatment Works. This includes material that would otherwise have been discharged to the River. The Kirtling Street site is not a CSO interception site.

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 combined electrical and control kiosk and ventilation column as well as the reconfigured concrete batching plant 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 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 would typically generate higher odour impacts than a higher height and so the lower height limit has been modelled in the assessment. For other topics such as townscape, the upper height may be more important and has been assessed. The approach that has been adopted in this regard is explained within each topic assessment section, where necessary.

3.4.8 The approximate dimensions provided for underground structures are internal dimensions which are determined by the hydraulic and access 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 main tunnel shaft are described in Section 3.2. Ground level access covers on the shaft would be used for access/egress by maintenance vehicles and personnel during planned inspections of the main tunnel and shaft. Those access covers to the main tunnel shaft which are only used for the ten yearly inspections (see below) would generally be buried under surface landscape treatments and not be visible.

Chambers and culverts

3.4.11 The chamber and related culverts are defined in Section 3.2 and would be required for the ventilation structures, and ducts would be required for cables and hydraulic pipelines. There would be covers on top of the chambers at ground level to allow access for inspection

3.4.12 There would be no interception chambers associated with the Kirtling Street shaft as there is no CSO at this site.

Air management structures

3.4.13 The heights and location of above ground air management structures, which comprise the ventilation column, are defined in Section 3.2.

3.4.14 A ventilation column integral with the electrical and control kiosk would be located either on the eastern or western boundary of the concrete batching plant site adjacent to the shaft (of 4m minimum to 6m maximum height). Details of this design structure are shown on the Kiosk and ventilation column design intent plan (see separate volume of figures – Section 1). The structure would be finished in high quality concrete and would include a brown roof.

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

Electrical and control kiosk

3.4.16 The height and location of the above ground electrical and control kiosk are defined in Section 3.2. This would be incorporated into the ventilation structure (the overall structure being of 4m minimum to 6m maximum height) and would contain gas monitors, electrical and control panels and metering equipment.

Other structures

3.4.17 The proposed development at the Kirtling Street site includes the retention of the concrete batching plant which would be reconfigured at the start of the construction phase. The parameters of this are defined in Section 3.2.

Permanent restoration and landscaping

3.4.18 Landscaping at this site is described in paras. 3.2.12 - 3.2.16. The final access arrangement and boundary wall design to Kirtling Wharf would be determined by the owner/concrete batching works/wharf operators and agreed with the London Borough of Wandsworth.

3.4.19 A right of access to the operational works area would be retained, and temporary security fencing would be installed when the area is required for maintenance access.

3.4.20 Most of the structures required for operating the Thames Tideway Tunnel would be below ground apart from the integrated ventilation column and electrical and control kiosk.

3.4.21 Maintenance vehicle access would be via Kirtling Street.

3.4.22 At the end of construction those parts of the site that are not public highway or concrete batching plant would be secured with high quality hoardings.

3.4.23 No new operational lighting would be provided for the development except for the concrete batching plant and a low level light to the electrical and control kiosk for maintenance purposes in hours of darkness. The light for the kiosk would only be activated by a directional motion control switch.

Typical maintenance regime

3.4.24 A light commercial vehicle would undertake three to six monthly maintenance inspections. This would be carried out during normal working hours and would take approximately half a day. There would be no aerial lighting. Additionally, once every ten years, more significant 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 14 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 Kirtling Street are listed below. A map showing their location is included in Vol 14 Figure 3.5.1 (see separate volume of figures).

a. Riverlight (Tideway Industrial Estate)
b. New Covent Garden Market
c. Nine Elms Parkside
d. Battersea Power Station
e. Embassy Gardens
f. US Embassy
g. Marco Polo House, 346 Queenstown Road
h. Nine Elms Sainsbury's, Wandsworth Road
i. 10 Pascal Street
j. Market Towers
k. Riverwalk House, Millbank
l. Vauxhall Sky Gardens, 143-161 Wandsworth Road
m. Vauxhall Square Cap Gemini Site
n. Chelsea Barracks, Chelsea Bridge Road
o. Island Site Vauxhall Gyratory
p. St Georges Wharf (Vauxhall Tower)
q. 30-60 South Lambeth Road
r. 1-9 Bondway and 4-6 South Lambeth Place
s. Northern Line Extension

3.6 On site alternatives

3.6.1 Project wide and site selection alternatives are addressed in Volume 1 Section 3. Since the Kirtling Street was selected as a preferred site at phase two consultation, the main alternative has been the revision of the layout to enable the retention of the existing concrete batching plant. During construction it is proposed that the existing concrete batching plant at the safeguarded Kirtling Wharf would be located towards the southern portion of the existing compound. This would remain the permanent location of the concrete batching plant to ensure that access can be provided to allow access for maintenance activities associated with the main tunnel to be undertaken.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 4: Air quality and odour

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling 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 Kirtling 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. temporary closure of roads during construction, which can lead to an increase in vehicle emissions through worsened congestion or through vehicles being routed onto other roads (air quality)

c. emissions from tugs pulling river barges (air quality)

d. emissions from construction plant (air quality)

e. construction-generated dust (air quality)

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

4.1.3 Each of these impacts is considered within the assessment. As a result the construction assessment for Kirtling Street site comprises four separate components: effects on local air quality from construction road traffic (taking account of temporary lane closures); effects on local air quality from tugs (for river barges); effects on local air quality from construction plant; and effects from construction dust. The effects on local air quality from construction road traffic, tugs (for river barges) 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 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 Volume 2 Environmental assessment methodology Section 4.33.

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 14 Kirtling Street FiguresFigures). Appendices supporting this site assessment are contained in Vol 14 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 Kirtling Street site would occur during the tunnel drive (Site Year 3 of construction). The average daily number of vehicle movements during the peak month would be approximately 192 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 Road traffic is likely to affect local air quality in two ways: from emissions from the construction traffic; and from increased emissions from other road vehicles due to congestion or re-routing due to road closures.

Tugs for river barges

4.2.6 River barges may affect local air quality through direct emissions from the tugs pulling them.

4.2.7 The peak monthly average would be eight barge movements a day averaged over a one month period in Site Year 3 of construction. The emissions associated with the tugs are presented in Vol 14 Appendix B.3.

Construction plant

4.2.8 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.

4.2.9 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.

4.2.10 Typical construction plant which would be used at the Kirtling Street site in the peak construction year and associated emissions data are presented in Vol 14 Appendix B.4.

Construction dust

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

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

a. site preparation and establishment

b. demolition of existing infrastructure and buildings

c. materials handling and earthworks including batching of concrete or grouts

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

4.2.12 At the Kirtling Street site there would be approximately 19,200m^3 of demolition material generated while the amount of amount of material moved during the earthworks would be approximately 1,664,000 tonnes. The volume of building material used during construction would be approximately 123,000m^3.

Code of Construction Practice

4.2.13 Appropriate dust and emission control measures are included in the *Code of Construction Practice* (*CoCP*)[ii] (Section 7) in accordance with the London Councils *Best Practice Guidance* (GLA and London Councils, 2006)[1]. Measures incorporated into the *CoCP* (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 Kirtling Street site. The effective implementation of the *CoCP* (Section 7) measures is assumed within the assessment.

4.2.14 There are no site-specific air quality measures contained in the *CoCP* (Section 7).

Operation

4.2.15 A ventilation structure would treat air released from the tunnel. The air would be treated by passing air through a carbon filter 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 the passive filter would be 2.0m^3/s. The maximum air release rate during a typical year is expected to be 1.0m^3/s therefore all air in a typical year would be treated through the passive filter. No nuisance odours are therefore expected.

4.2.16 Air would be released from the ventilation structure for about 15 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.

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

Environmental design measures

4.2.17 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 2Section 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 14 Table 4.3.1).

Vol 14 Table 4.3.1 Air quality and odour – stakeholder engagement

Organisation	Comment	Response
London Borough (LB) of Wandsworth, Position Paper response, March 2011	Agree monitoring locations with LB of Wandsworth	Locations were agreed with LB of Wandsworth Environmental Health Officer.
LB of Wandsworth, Position Paper response, March 2011	Odour complaints in the area should be considered	No odour complaints - confirmed by LB of Wandsworth Team Leader (Environmental Initiatives).

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 Kirtling Street site. The neighbouring Thames Tideway Tunnel project site at Heathwall Pumping Station could elevate construction dust nuisance effects within the assessment area (see para. 4.3.5 below) and is therefore considered in the dust assessment. 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 Kirtling Street 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 a square area of 700m by 800m centred on the Kirtling Street site (which therefore includes the Heathwall Pumping Station site). This assessment area has been used for the assessment of road transport, tugs for river barges, construction plant and construction dust and has been selected on the basis of professional judgement to ensure that the effects of the Kirtling 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 3 of construction) has been used as the year of assessment for construction effects (construction road and river transport, construction plant and construction dust) in which the development case (with Thames Tideway Tunnel project) has been assessed against the base case (without 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 14 Appendix N), there are seven other new developments (Northern Line Extension, Riverlight, New Covent Garden Market, Nine Elms Parkside, Embassy Gardens, Battersea Power Station and US Embassy) identified within 400m of the Kirtling Street site (construction assessment area), four of which (Riverlight, New Covent Garden Market Embassy Gardens and Battersea Power Station) are relevant to the air quality assessment being sensitive properties within 200m of the site that would be partially or fully complete and occupied in Site Year 3 of construction. These developments are therefore considered as receptors in the air quality assessment. Trips associated with all seven developments are taken into account in the traffic data used for the air quality assessment.

4.3.9 Of the seven developments identified, five (New Covent Garden Market, Northern Line Extension, Nine Elms Parkside, Embassy Gardens and Battersea Power Station) would be under construction at the same time as construction works at the Kirtling Street site (in the peak construction year). These are therefore considered in the cumulative construction assessment.

Operation

4.3.10 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.

4.3.11 Section 4.6 details the likely significant effects arising from the operation at the Kirtling Street site. The neighbouring Thames Tideway Tunnel project site at Heathwall Pumping Station could give rise to additional effects on odour within the assessment area for this site and is therefore considered in the odour assessment.

Operational assessment area

4.3.12 Odour dispersion modelling has been carried out over an area of 850m by 650m centred on the Kirtling 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

4.3.13 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

4.3.14 Due to their proximity to the site, five other developments (Riverlight, New Covent Garden Market, Nine Elms Parkside, Embassy Gardens and Battersea Power Station) have been identified for inclusion in the odour assessment and are included as receptors. The proposed buildings at Riverlight, Battersea Power Station and Nine Elms Parkside have also been included in the modelling as these buildings may affect dispersion. Due to the nature of the developments, there are however no cumulative operational effects to assess.

Assumptions and limitations

Assumptions

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

Construction

4.3.16 The site specific assumptions in terms of model inputs for the local air quality dispersion modelling are set out in Vol 14 Appendix B.1.

Operation

4.3.17 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. 4.2.15-4.2.17.

4.3.18 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 low as there have only been four complaints in the surrounding area over recent years (see para. 4.4.12) and 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].

4.3.19 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

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

Construction

4.3.21 As there are no PM_{10} monitoring sites located within the immediate vicinity of the Kirtling Street site, it has not been possible to verify PM_{10} modelling results[iii]. The adjustment factor derived for NO_x (from a comparison of modelled and monitored NO_x data) has therefore been applied to the PM_{10} modelling results.

4.3.22 It is noted that the 2011 PM_{10} monitoring data from the closest monitoring station (too far away for verification purposes) reported in the baseline (Section 4.4) are not yet fully ratified[iv]. The lack of full ratification does mean that the characterisation of the existing baseline PM_{10} concentration is less certain. However, there are no direct implications for the assessment, as this concentration is not used in the assessment for verification purposes or as the background concentration used in the modelling.

Operation

4.3.23 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.

[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.

[iv] The process of data ratification generally involves a first level screening of the data (by manual and/or automatic methods), to remove obvious erroneous values. These data will have been suitably calibrated against reference standards. Within the national monitoring networks, these validated data are labelled “provisional”. The secondary process in data ratification involves a more thorough checking of the data, for example, data rescaling to allow for drift in the calibration standards, or data adjustments following site audits, which have identified problems that could not have been identified remotely.

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 is one continuous monitoring station and one diffusion tube which collect data pertinent to the Kirtling Street site and associated construction traffic routes which are operated by the LB of Lambeth and the LB of Wandsworth respectively. The location of these is shown in Vol 14 Figure 4.4.1 (see separate volume of figures). Monitoring data for these sites for the period 2007-2011 are contained in (NO_2 concentrations) and Vol 14 Table 4.4.2 (PM_{10} concentrations).

Vol 14 Table 4.4.1 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 site											
Bondway Interchange (LB5)	Roadside	**77***	**77**	**77****	**83**	NM	4 (178)*	17	12 (194)**	**38**	NM
Diffusion tube monitoring site											
Newton Prep School (W3)	Roadside	**63**	**53**	**59**	**67**	**64**	NM				

*Notes: NM indicates not measured. Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m3 for the annual mean and 200µg/m3 for the hourly mean which can be exceeded 18 times per year. Codes in brackets represent monitoring site identifiers used in Vol 14 Figure 4.4.1 (see separate volume of figures). * Data capture was 81%, the figure in brackets for the hourly exceedances is the 99.8th percentile. ** Data capture was 88%, the figure in brackets for the hourly exceedances is the 99.8th percentile.*

Vol 14 Table 4.4.2 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
Continuous monitoring site											
Bondway Interchange (LB5)	Roadside	**43***	**43****	**42*****	**52**	**67******	**92***	**76****	**71*****	**160**	**211******

*Notes: Emboldened figures indicate an exceedance of the objective / limit value 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 14 Figure 4.4.1 (see separate volume of figures). * Data capture was 79%. ** Data capture was 78%. *** Data capture was 85%. **** Data capture was 85%.*

4.4.5 The monitoring data at these sites show that the annual mean NO_2 objective / limit value ($40 \mu g/m^3$) was exceeded at both roadside sites in each of the five years. The hourly mean NO_2 objective / limit value was exceeded in one of the five years at the Bondway Interchange (LB5) roadside site.

4.4.6 The annual and daily mean PM_{10} objectives / limit values were also exceeded in all five years at the monitoring sites.

4.4.7 As a result of previous exceedances of air quality objectives, the LB of Wandsworth has declared the whole borough an Air Quality Management Area (AQMA) for both NO_2 and PM_{10}.

4.4.8 Diffusion tube monitoring has also been undertaken as part of the environmental impact assessment (EIA) to monitor NO_2 concentrations in the vicinity of the Kirtling Street site. This monitoring comprises seven diffusion tubes based at the locations identified in Vol 14 Table 4.4.3, which 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 2011/2012 measurements are adjusted for bias using the co-located diffusion tubes and then are seasonally adjusted. Annual mean NO_2 concentrations, for the period covered by the diffusion tubes, and for the year 2010 have been collated from four nearby background continuous monitoring sites measuring NO_2 and with data capture rates greater than 90%. The average of the ratios between the period and annual means has been used to calculate the seasonal adjustment factor. To enable any bias to be corrected, a triplicate site (comprising three diffusion tubes) was established at a continuous monitoring site in Putney (site PEFM4 – see Vol 7); for additional precision, a triplicate site was established at one of the monitoring sites (HEAM1) near the Kirtling Street site; otherwise all the monitoring locations have single tubes.

Vol 14 Table 4.4.3 Air quality – additional monitoring locations

Monitoring site	Grid reference	Site type	2010 NO_2 annual mean ($\mu g/m^3$)
Cringle Street / Kirtling Street (KSTM1)	529325, 177446	Kerbside	**66.0**
Kirtling Street(KSTM2)	529242, 177391	Roadside	**50.8**
Nine Elms Lane / New Covent Garden Market (KSTM3)	529333, 177371	Kerbside	**74.2**
Thessaly Road / Battersea Park Road (KSTM4)	529138, 177243	Kerbside	**58.8**
Battersea Park Road / Battersea Dog and Cat	528971, 177144	Roadside	**84.7**

Monitoring site	Grid reference	Site type	2010 NO_2 annual mean ($\mu g/m^3$)
Home (KSTM5)			
Nine Elms Lane / Riverside Court (HEAM1)	529838, 177749	Roadside	**78.7**
Nine Elms Lane / Post Office Depot (HEAM2)	529448, 177499	Kerbside	**90.9**

Note: Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m^3 for the annual mean.

4.4.9 All seven sites measured concentrations above the NO_2 annual mean standard (40µg/m^3). These concentrations are in line with the local authority monitoring at roadside sites and are typical of the high levels in London.

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

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 Kirtling Street site are given in Vol 14 Table 4.4.4 for 2010 (baseline year).

Vol 14 Table 4.4.4 Air quality – 2010 background pollutant concentrations

Pollutant*	2010
NO_2 ($\mu g/m^3$)	43.9
PM_{10} ($\mu g/m^3$)	22.9

** Annual mean for 1km grid square centred on 529500, 177500.*

Odour

4.4.12 The LB of Wandsworth has not received any odour complaints for the local area over recent years (LB of Wandsworth, 2012)[6]. The Thames Water complaints database was reviewed for an area within a 500m radius of the zones identified for the proposed ventilation structure. Over the last five years (2007–2011), four complaints were made.

4.4.13 Data gathering for the EIA included spot measurements of H_2S made near the site, the results of which are summarised in Vol 14 Table 4.4.5 and the monitoring locations shown in Vol 14 Figure 4.4.2 (see separate volume of figures). The highest concentrations, up to 8.8µg/m^3, were measured on 4

January 2012 during westerly wind conditions. These levels are typical of urban areas3 when a faint odour may be detectable on occasions (WHO, 2000)[7,v].

Vol 14 Table 4.4.5 Odour – measured H_2S concentrations

Location	Grid reference	Date	Time	H_2S concentration ($\mu g/m^3$)
Kirtling Street (KSTS1)	529347, 177537	28/08/11	10:55:38	0.0
		28/08/11	10:56:13	0.0
		11/10/11	16:39:15	6.2
		11/10/11	16:40:23	4.5
		30/10/11	10:28:47	6.9
		30/10/11	10:29:20	5.1
Kirtling Street / Cemex (KSTS2)	529249, 177542	28/08/11	10:58:06	0.0
		28/08/11	10:58:39	0.0
		11/10/11	16:42:16	5.6
		11/10/11	16:43:38	5.2
		30/10/11	10:30:18	6.2
		30/10/11	10:30:46	4.6
		04/01/12	13:22:02	8.1
		04/01/12	13:23:09	7.4
		20/02/12	16:21:06	7.6
		20/02/12	16:22:06	5.9
		21/05/12	11:14:45	7.7
		21/05/12	11:15:59	7.2
Nine Elms (KSTS3)	529323, 177611	28/08/11	11:03:36	0.0
		28/08/11	11:04:06	0.0
		11/10/11	16:45:38	5.7
		11/10/11	16:46:41	5.2
		30/10/11	10:32:44	5.1
		30/10/11	10:33:12	0.0
		04/01/12	13:25:15	7.4

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

Location	Grid reference	Date	Time	H_2S concentration ($\mu g/m^3$)
		04/01/12	13:26:00	6.8
		20/02/12	16:23:42	5.4
		20/02/12	16:24:47	5.2
		20/02/12	16:23:42	5.4
		20/02/12	16:24:47	5.2
		21/05/12	11:17:32	6.5
		21/05/12	11:19:00	6.7
Nine Elms (KSTS4)	529378, 177612	28/08/11	11:05:04	0.0
		28/08/11	11:05:33	0.0
		11/10/11	16:48:48	5.8
		11/10/11	16:49:50	5.2
		30/10/11	10:33:45	0.0
		30/10/11	10:34:13	4.5
		04/01/12	13:28:56	8.8
		04/01/12	13:29:48	7.5
		20/02/12	16:27:05	7.5
		20/02/12	16:28:10	5.2
		20/02/12	16:27:05	7.5
		20/02/12	16:28:10	5.2
		21/05/12	11:21:11	7.1
		21/05/12	11:22:28	7.2
Meteorological conditions: 28/08/11 SW wind up to 2.0m/s, partially cloudy, rain on previous day. 11/10/11 W wind up to 2.3m/s, partially cloudy. 30/10/11 SW wind at 0.5m/s, cloudy, last rain on 27/10/11 04/01/12 W wind up to 4.7m/s, partially cloudy. 20/02/12 W wind up to 3.1m/s, partially cloudy. 21/05/12 NE wind, average speed 2.7m/s				

Receptors

4.4.14 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 14 Figure 4.4.3 (see separate volume of figures) and the table below (Vol 14 Table 4.4.6) for the Kirtling 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.

4.4.15 It is noted that Vol 14 Table 4.4.6 includes receptors associated with five other new developments (Riverlight, New Covent Garden Market, Nine Elms Parkside, Embassy Gardens and Battersea Power Station, see site development schedule in Vol 14 Appendix N) for consideration in the air quality and odour assessments.

Vol 14 Table 4.4.6 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, river tugs for barges and construction plant)	Construction dust (on-site demolition and construction processes)	Odour (ventilation column)
Residential - Nine Elms Pier houseboats (KSTR3)	Adjacent	High (exposure relevant for annual mean, daily mean and hourly mean standards)	Medium	High
Residential - Riverlight development (KSTR5)*	Adjacent	High (exposure relevant for annual mean, daily mean and hourly mean standards)	Medium	High
Residential - Nine Elms Parkside development (KSTR8)*	20m east	Not included as a receptor as the development is still under construction in Site Year 3.		High
Residential - 33 Nine Elms Lane (KSTR9)	20m south	High (exposure relevant for annual mean, daily mean and hourly mean standards)	Medium	High
Residential - Battersea Power Station development (KSTR1)*	55m west	High (exposure relevant for annual mean, daily mean and hourly mean standards)	Medium	High
Residential - Embassy Gardens (KSTR7)*	130m east	High (exposure relevant for annual mean, daily mean and hourly mean standards)	Medium	High
Industrial - Tideway Industrial Estate warehouses (KSTR6)	Adjacent	Low (exposure not relevant for any of the criteria)	Medium	Medium
Commercial - Booker	40m south	Low (exposure not relevant for	Medium	Medium

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, river tugs for barges and construction plant)	Construction dust (on-site demolition and construction processes)	Odour (ventilation column)
Cash and Carry, Battersea Park Road (KSTR11)		any of the criteria)		
Commercial - New Covent Garden Market (KSTR10)*	320m south	Low (exposure not relevant for any of the criteria)	High	Medium
Recreational – River Thames (KSTR2)	Adjacent	Low (exposure relevant for the hourly mean standard only)	Low	Low
Recreational - Thames Path (KSTR4)	Adjacent	Low (exposure relevant for the hourly mean standard only)	Low	Low

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

Construction base case

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

4.4.17 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 3 of construction. Euro standards define the acceptable exhaust emission limits for new vehicles sold in the EU. These standards are defined through a series of European Union directives staging the progressive introduction of increasingly stringent standards over time. The uptake of newer vehicles with improved emission controls should lead to a reduction in NO_2 and PM_{10} concentrations over time. These changes in the fleet composition and the emissions are covered in this assessment.

4.4.18 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].

4.4.19 Background pollutant concentrations for Site Year 3 of construction (peak construction year) used in the modelling are shown in Vol 14 Table 4.4.7. The background NO_2 and PM_{10} concentrations have been taken from the Defra mapped background data5.

Vol 14 Table 4.4.7 Air quality – annual mean background pollutant concentrations

Pollutant	Baseline (2010)	Peak construction year (Site Year 3 of construction)
NO_2 ($\mu g/m^3$)*	39.9	29.6
PM_{10} ($\mu g/m^3$)*	22.6	20.5

** Taken from Defra mapped 1km grid square centred on 529500, 177500. Adjusted to ensure local A roads are not double counted.*

4.4.20 As described in Section 4.3, the base case in Site Year 3 of construction takes into account the four neighbouring developments (Riverlight, New Covent Garden Market, Embassy Gardens and Battersea Power Station) including them as receptor locations in the air quality assessment. These are included in the receptor list provided in Vol 14 Table 4.4.6.

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 for the odour assessment takes into account the five developments (Riverlight, New Covent Garden Market, Nine Elms Parkside, Embassy Gardens and Battersea Power

Station) including them as receptor locations in the odour assessment. These are included in the receptor list provided in Vol 14 Table 4.4.6. Three new developments have been included in the odour modelling as the structures may affect dispersion, these buildings are listed in para. 4.3.14.

4.5 Construction effects assessment

Local air quality assessment

4.5.1 Construction effects on local air quality (comprising emissions from construction road traffic, tugs for river barges 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 3 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 14 Table 4.4.6).

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

4.5.3 A model verification exercise has been undertaken at the Kirtling Street site in line with the Defra guidance LAQM.TG(09)9. This checks the model performance against measured concentrations, using the seven monitoring sites established for this assessment and one local authority monitoring site (KSTM1–KSTM5 and HEAM1-HEAM2, see Vol 14 Table 4.4.3 and W3, see Vol 14 Table 4.4.1). Further details regarding the verification process are included in Vol 14 Appendix B.1. The model adjustment factor derived from the verification process was applied to all model results for both NO_2 and PM_{10}.

4.5.4 The model inputs for the local air quality assessment for the Kirtling Street site are also detailed in Vol 14 Appendix B.2, B.3 and B.4. This includes road traffic data (comprising annual average daily traffic flows, heavy good vehicle proportions and speeds for each road link) and data pertaining to the tugs for river barges and construction plant.

NO_2 concentrations

4.5.5 Predicted annual mean NO_2 concentrations for the modelled scenarios, are shown in Vol 14 Table 4.5.1. This table details the forecast NO_2 concentrations at specific sensitive receptors. Annual mean results are shown for all of the sensitive receptors but the receptors are divided into two groups depending on whether the annual mean objective/limit value applies or not. The annual mean criteria only apply at those receptors which could be occupied continually for a year (eg, residential properties). Exceedances of the hourly criteria are inferred from the annual mean concentration. Additionally, contour plots are provided (Vol 14 Figure 4.5.1 to Vol 14 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 14 Figure 4.5.4 (see separate volume of figures).

4.5.6 The modelled concentrations in Vol 14 Table 4.5.1 show that annual mean NO_2 levels are predicted to decrease between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. This decrease is due to predicted reductions in background concentrations and improved vehicle engine technology. The results for the development case show increases over the base case at all modelled receptors due to the construction works at the Kirtling Street site.

4.5.7 Exceedances of the annual mean criterion (40µg/m^3) are predicted at all receptors in the baseline case, four of the eleven receptors in the base case and five of the eleven receptors in the development case. In line with LAQM.TG(09)9, at receptors with modelled concentrations above 60µg/m^3, exceedances of the hourly NO_2 air quality objective / limit value are considered likely. Exceedances of this objective / limit value are likely to occur at three receptors in the baseline case and at one receptor in the base and development cases.

Vol 14 Table 4.5.1 Air quality - predicted annual mean NO_2 concentrations

Receptor	Predicted annual mean NO_2 concentration (µg/m^3)			Change between base 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					
Nine Elms Pier houseboats (KSTR3)	**43.9**	32.1	33.6	1.5	Small
Riverlight residential (KSTR5)*	**50.1**	36.8	38.7	1.9	Small
33 Nine Elms Lane residential (KSTR9)	**69.2**	**51.8**	**53.1**	1.3	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		
Battersea Power Station residential (KSTR1)*	**42.2**	31.1	31.4	0.3	Negligible
Embassy Gardens residential (KSTR7)*	**87.4**	**65.4**	**66.1**	0.7	Small
Receptors where the annual mean objective / limit value does not apply					
Tideway Industrial Estate warehouses (KSTR6)	**51.9**	38.1	**40.6**	2.5	Medium
Booker Cash and Carry, Battersea Park Road (KSTR11)	**70.9**	**53.2**	**54.0**	0.8	Small
New Covent Garden Market (KSTR10)*	**49.1**	35.9	36.2	0.3	Negligible
River Thames (KSTR2)	**42.2**	31.1	32.0	0.9	Small
Thames Path (KSTR4)	**44.3**	32.4	34.4	2.0	Medium

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

4.5.8 The highest predicted increase in annual mean concentration as a result of the construction works at the Kirtling Street site is 2.5µg/m³ which is predicted at receptor KSTR6 at the Tideway Industrial Estate warehouses. However, the annual mean objective / limit value (40µg/m³) does not apply here. The largest increase at a receptor of relevant exposure to the annual mean concentration is 1.9µg/m³ at the proposed Riverlight development (KSTR5). This increase is described as small magnitude according to the criteria detailed in Vol 2 Section 4.

4.5.9 Using the criteria set out in Vol 2 Section 4, the significance of effects would be **minor adverse** at the residential properties the Riverlight development (KSTR5), Embassy Gardens (KSTR7) and 33 Nine Elms Lane (KSTR9), which have a high sensitivity to local air quality. At the residential developments at Battersea Power Station development (KSTR1) and the Nine Elms Pier houseboats (KSTR3), which have a high sensitivity to local air quality, the significance of the effect would be **negligible**. The significance of effects would also be **negligible** at the Thames Path (KSTR4), River Thames (KSTR2), New Covent Garden Market (KSTR10), Tideway Industrial Estate warehouses (KSTR6) and Booker Cash and Carry (KSTR11), which have a low sensitivity to local air quality.

PM_{10} concentrations

4.5.10 Predicted annual mean PM_{10} concentrations for the modelled scenarios, taking account of emissions from construction road traffic, tugs for river barges and construction plant, are shown in Vol 14 Table 4.5.2. This table details the forecast PM_{10} concentrations at specific sensitive receptors. Additionally, contour plots are provided (Vol 14 Figure 4.5.5 to Vol 14 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 14 Figure 4.5.8 (see separate volume of figures).

4.5.11 The modelled concentrations in Vol 14 Table 4.5.2 show that annual mean concentrations of PM_{10} are predicted to achieve the annual mean criteria ($40 \mu g/m^3$) 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 increases over the base case at all modelled receptors due to construction activities at the Kirtling Street site.

Vol 14 Table 4.5.2 Air quality - predicted annual mean PM_{10} concentrations

Receptor	Predicted annual mean PM_{10} concentration (µg/m3)			Change between base and dev cases (µg/m3)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Receptors where the annual mean objective / limit value applies					
Nine Elms Pier houseboats (KSTR3)	23.1	20.9	21.2	0.2	Negligible
Riverlight residential (KSTR5)*	24.0	21.6	21.9	0.2	Negligible
33 Nine Elms Lane residential (KSTR9)	28.0	24.9	25.1	0.2	Negligible
Battersea Power Station residential (KSTR1)*	22.9	20.8	20.8	0.0	Negligible
Embassy Gardens residential (KSTR7)*	31.0	27.1	27.2	0.1	Negligible
Receptors where the annual mean objective / limit value does not apply					
Tideway Industrial Estate warehouses (KSTR6)	24.3	21.9	22.2	0.3	Negligible
Booker Cash and Carry, Battersea Park Road (KSTR11)	28.5	25.3	25.4	0.1	Negligible
New Covent Garden Market (KSTR10)*	24.0	21.6	21.6	0.1	Negligible
River Thames (KSTR2)	22.9	20.7	20.9	0.1	Negligible
Thames Path (KSTR4)	23.2	21.0	21.2	0.3	Negligible

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

4.5.12 The largest predicted increase in the annual mean concentration as a result of construction at the Kirtling Street site is 0.3µg/m^3, predicted at the Thames Path (KSTR4) and the Tideway Industrial Estate warehouses (KSTR6). However, the annual mean objective / limit value (40µg/m^3) does not apply at these receptors. The largest increase at a receptor of relevant exposure to the annual mean concentration is 0.2µg/m^3 at the Nine Elms Pier houseboats (KSTR3), the Riverlight development (KSTR5) and 33 Nine Elms Lane (KSTR9). 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 14 Table 4.5.3 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.

Vol 14 Table 4.5.3 Air quality – predicted exceedances of the daily PM_{10} standard

Receptor	Predicted number of exceedances of the daily PM_{10} standard			Change between base 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					
Nine Elms Pier houseboats (KSTR3)	8	5	5	0	Negligible
Riverlight residential (KSTR5)*	10	6	6	0	Negligible
33 Nine Elms Lane residential (KSTR9)	21	12	13	0	Negligible
Battersea Power Station residential (KSTR1)*	8	4	4	0	Negligible
Embassy Gardens residential (KSTR7)*	31	18	18	0	Negligible
Receptors where the objective / limit value does not apply					
Tideway Industrial Estate warehouses	11	6	7	1	Small

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		
(KSTR6)					
Booker Cash and Carry, Battersea Park Road (KSTR11)	22	13	13	0	Negligible
New Covent Garden Market (KSTR10)*	10	6	6	0	Negligible
River Thames (KSTR2)	8	4	5	0	Negligible
Thames Path (KSTR4)	8	5	5	0	Negligible

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

4.5.15 The results in Vol 14 Table 4.5.3 show that the number of daily exceedances of PM_{10} is predicted to decrease between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. The decreases are due to predicted reductions in background concentrations and improved vehicle engine technology. At the receptors where the daily objective does apply, the results for the development case show a no increase in the number of days per year with concentrations above 50µg/m^3 compared with the base case at the modelled receptors due to construction works at the Kirtling Street site. This represents an impact of negligible magnitude according to the criteria in Vol 2 Section 4.

4.5.16 With no exceedances of the of the daily PM_{10} criteria in the development case, the significance of the effects would be negligible at all receptors.

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 and proposed receptors. Based on the development schedule (Vol 14 Appendix N), it is possible that as a result of the one year delay, more of the New Covent Garden Market, Battersea Power Station and Embassy Gardens developments and some of the Nine Elms Parkside 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 as 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 Kirtling Street site in accordance with the criteria in Vol 2 Section 4, as described in Vol 14 Table 4.4.6. A summary of the approximate numbers of receptors in distance bands from the Kirtling Street site in the development case is detailed in Vol 14 Table 4.5.4.

Vol 14 Table 4.5.4 Air quality - numbers of dust sensitive receptors

Buffer distance (m)	Number of receptors*	Receptor type
<20	100-500	Riverlight development, Nine Elms Pier houseboats, industrial, storage and distribution
20-50	More than 500	Riverlight development, Nine Elms Pier houseboats, Post Office Depot development, industrial, storage and distribution
50-100	More than 500	Riverlight development, Nine Elms Pier houseboats, Post Office Depot development, Battersea Power Station development, industrial, storage and distribution
100-350	More than 500	Riverlight development, Post Office Depot development, Battersea Power Station development, US Embassy, Embassy Gardens development, industrial, storage and distribution

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

4.5.20 In line with the 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 Kirtling Street site is classified as a ‘small’ dust emission class. This classification is based on the small size of the demolition volumes, which is less than 20,000m^3. As the nearest receptor is within 20m of the construction site, this makes the risk category for demolition activities medium risk.

4.5.22 The earthworks have been assessed to be a ‘large’ dust emission class as the total material to be moved is more than 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 Kirtling Street site has a ‘high’ dust emission class. This classification is based on the large volumes of materials used and the use of on-site concrete batching. The risk category for construction activities is therefore assessed to be high risk.

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

4.5.25 The risk categories for the four activities are summarised in Vol 14 Table 4.5.5. This summary of these risks does not take into account the measures outlined in the *CoCP* (Section 7).

Vol 14 Table 4.5.5 Air quality – summary of construction dust risks

Source	Dust soiling / PM10 effects
Demolition	Medium risk site
Earthworks	High risk site
Construction	High risk site
Trackout	High risk site

Note: without CoCP (Section 7)measures

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

4.5.27 Although the receptor sensitivity (with respect to construction dust nuisance) is identified as medium for all receptors apart from footpaths and New Covent Garden Market (as identified in Vol 14 Table 4.4.6), due to the duration of the works, the other developments being constructed in the area, the proximity to the Heathwall Pumping Station site and the number of sensitive receptors in the locality, the sensitivity of the area has been defined as ‘very high’.

4.5.28 With regard to the significance of effects, a high risk site with a very high sensitivity of the area would result in an overall major adverse effect without control measures. When the measures outlined in the *CoCP* (Section 7)are applied, the significance of the effect would be reduced to **minor adverse** at any dust sensitive receptors within 50m of the site (in accordance with IAQM guidance). The significance of construction dust effects at receptors greater than 50m from the site boundary would be minor adverse without the *CoCP* (Section 7) measures but considered **negligible** with the measures. The significance of the effect for each receptor is summarised in Vol 14 Table 4.5.6.

Vol 14 Table 4.5.6 Air quality - significance of construction dust effects

Receptor	Significance of effect
Nine Elms Pier houseboats (KSTR3)	Minor adverse
Riverlight residential (KSTR5)*	Minor adverse
Post Office Depot residential (KSTR8)*	Minor adverse
33 Nine Elms Lane residential (KSTR9)	Minor adverse
Battersea Power Station residential (KSTR1)*	Negligible
Embassy Gardens residential (KSTR7)*	Negligible
Tideway Industrial Estate warehouses (KSTR6)	Minor adverse
Booker Cash and Carry, Battersea Park Road (KSTR11)	Minor adverse
New Covent Garden Market (KSTR10)*	Negligible
River Thames (KSTR2)	Minor adverse
Thames Path (KSTR4)	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 14 Table 4.6.1 shows the predicted maximum ground level odour concentrations at the Kirtling 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 in a year to exceed 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 14 Table 4.6.1 Odour - impacts and magnitude – operation

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

4.6.2 In Vol 14 Table 4.6.1 above, the 98^{th} percentile is shown as zero as air would be released from the ventilation structure 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 would occur within 10m of the ventilation column with concentrations reducing rapidly away from this area. There would be no hours with an odour concentration greater than $1.5ou_E/m^3$ so there would be no detectable odour on an hourly basis at any location. With a frequent use year (ie, a more rainy year than average), the situation would be the same with no detectable odour when considering hourly average concentrations.

4.6.4 With regard to the significance of effects given that the predicted odour concentrations at all locations would not exceed the 98^{th} percentile benchmark of $1.5ou_E/m^3$, 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 Five developments were identified in Section 4.3 (New Covent Garden Market, Northern Line Extension, Nine Elms Parkside, Embassy Gardens and Battersea Power Station) as potentially giving rise to cumulative effects with construction activities taking place at the same time as the Kirtling Street site. This cumulative effect has been taken into account by increasing the sensitivity of the area to construction dust. The traffic effects from these developments have already been accounted for in the traffic data used for the air quality assessment. Therefore the effects on local 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 above developments may be built and occupied which would lead to a corresponding reduced level of cumulative activity. Cumulative effects would therefore be no greater than described above.

Operational effects

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

4.8 Mitigation

Construction

4.8.1 Control measures of relevance to air quality are embedded in the *CoCP* (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. 4.2.17), no mitigation is required because effects are not significant.

Monitoring

4.8.3 It is envisaged that an appropriate particulate monitoring regime would be agreed with the LB of Wandsworth prior to commencement of construction at the Kirtling 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 14 Table 4.10.1 Air quality – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential - Nine Elms Pier houseboats (KSTR3)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Residential - Riverlight development (KSTR5)*	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Minor adverse	None	Minor adverse
Residential - 33 Nine Elms Lane (KSTR9)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Minor adverse	None	Minor adverse
Residential - Battersea Power Station development (KSTR1)*	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Residential - Embassy Gardens (KSTR7)*	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Negligible	None	Negligible
Industrial - Tideway Industrial Estate	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
warehouses (KSTR6)	Effects from construction dust	Minor adverse	None	Minor adverse
Commercial - Booker Cash and Carry, Battersea Park Road (KSTR11)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Commercial - New Covent Garden Market (KSTR10)*	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Recreational - River Thames (KSTR2)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Recreational - Thames Path (KSTR4)	Local air quality – effects from construction road traffic, tugs for river barges 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 14 Table 4.10.2 Odour – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential -Nine Elms Pier Houseboats (KSTR3)	Odour	Negligible	None	Negligible
Residential - Riverlight development (KSTR5)*		Negligible	None	Negligible
Residential - Nine Elms Parkside development (KSTR8)*		Negligible	None	Negligible
Residential - 33 Nine Elms Lane (KSTR9)		Negligible	None	Negligible
Residential - Battersea Power Station development (KSTR1)*		Negligible	None	Negligible
Residential - Embassy Gardens (KSTR7)*		Negligible	None	Negligible
Industrial - Tideway Industrial Estate warehouses (KSTR6)		Negligible	None	Negligible
Commercial - Booker Cash and Carry, Battersea Park Road (KSTR11)		Negligible	None	Negligible
Commercial - New Covent Garden Market (KSTR10)*		Negligible	None	Negligible
Recreational - River Thames (KSTR2)		Negligible	None	Negligible
Recreational - Thames Path (KSTR4)		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*. Available at: http://www.legislation.gov.uk/ukpga/1995/25/contents. Accessed June 2012.

[5] Defra. Maps 2010. Available at: http://laqm.defra.gov.uk/maps/maps2010.html. Accessed June 2012.

[6] London Borough of Wandsworth, Personal Communication, July 2012.

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

[8] Defra. *Emissions*. Available at: 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

Thames Water

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 5: Ecology - aquatic

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

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling Street site assessment

Section 5: Ecology – aquatic

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5 Ecology – aquatic

5.1 Introduction

5.1.1 This document presents the findings of the assessment of the likely significant effects of the proposed development on aquatic ecology at the Kirtling Street site.

5.1.2 The proposed development may lead to effects on aquatic ecology due to the physical works in-river during construction of a new jetty and associated conveyors. Operational effects for aquatic ecology for this site are not considered likely and have therefore not been assessed. This is on the basis that there would be no (combined sewer overflow) CSO interception at this site or permanent in-river works.

5.1.3 The project wide effects of the Thames Tideway Tunnel project on aquatic ecology are assessed in Volume 3 (Project-wide effects assessment).

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

5.1.5 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling 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 aquatic ecology are set out below.

Construction

5.2.2 The only in-river works associated with this site are the presence of a jetty for removing excavated material and two associated conveyors (all supported on piled piers installed from a jack-up barge) during the construction period (as shown in the Construction Phases: Phase 1 Site Setup Drawing) and their subsequent removal at the end of the construction period. Construction activities would occur over six years, with structures in place for five and a half years.

5.2.3 The jetty (which would be 130m x 7.5m in size) would be capable of berthing three barges. A small amount of dredging would be associated with this structure.

5.2.4 The highest number of barge movements at Kirtling Street (a monthly average of eight barge movements per day) would be associated with main tunnel construction (Site Year 2 to Site Year 4). Since this would be a tunnel double drive site, there would be 24 hour working and associated lighting adjacent to the river.

Code of construction practice

5.2.5 The *Code of Construction Practice (CoCP*[i]*)* sets out the standards, procedures, and measures for managing and reducing construction effects. These measures would be implemented through a *Construction environment management plan* (*CEMP*) prepared by the contractor to control site operations and works.

5.2.6 The *CoCP Part A* includes the following measures, which are an integral part of the project and relevant for the purposes of this assessment:

a. The location of barges resting on the foreshore and river bed would be controlled to reduce extent of potential environmental impacts (*CoCP Part A* Section 11).

b. Avoiding piling at night to ensure free windows of opportunity to allow fish to migrate past the site within each 24-hour period (*CoCP Part A* Section 6).

c. Undertaking noise measurements at prescribed points and intervals to ensure compliance with the *CoCP* (*CoCP Part A* Section 6).

d. Limiting allowable noise and vibration levels such that part of the river cross-section is passable at all times (*CoCP Part A* Section 6).

e. Where technically feasible, utilising low noise/vibration cofferdam or pile/pier installation techniques such as pressing or vibro-piling rather than impact/percussive piling. In the event that in-river percussive piling is needed, prior approval from the EA would be required (*CoCP Part A* Section 6).

f. Where vibro-piling is used, slowly increasing the power of the driving to enable fish to swim away before the full power of the pile driver is felt through the river (*CoCP Part A* Section 6).

g. The contractor would make every reasonable effort to remove all piles completely from the bed of the river. With the prior written agreement of the PLA the contractor would ensure any piles which prove impossible to fully extract on application of the confirmed minimum crane pull of 40 tonnes, are driven down, cut off or removed to a depth of a least 1 metre below the adjacent riverbed level unless advised otherwise (*CoCP Part A* Section 4).

h. Avoidance of pollution of the river through measures that accord with the principles set out in industry guidelines, including the EA note *PPG05: Works in, near or liable to affect water courses* (Environment Agency, undated)[2] and Construction Industry Research and Information Association (CIRIA) report *C532: Control of water*

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

pollution from construction sites (CIRIA, 2001)[3] (*CoCP Part A* Section 8).

i. Appropriate measures would be taken with regard to ‘in river’ works to minimise the release of suspended sediment and solids into the water column (*CoCP Part A* Section 8).

j. Dredging would be undertaken in accordance with any dredging licenses and required permissions from the MMO and EA to ensure stability of defence walls is not affected, and for ecological requirements and compliance with the Water Framework Directive. Where sites that may require dredging lie within the stretch of the river known to support spawning habitat for smelt and dace, due regard should be given so as to minimise any impact on biodiversity within the river and the Salmon and Freshwater Fisheries Act 1975 (*CoCP Part A* Section 8).

k. For works where materials are being loaded and unloaded on the river, the Contractor would be required to establish suitable management arrangements and mitigation measures so as to prevent spillage of transferred materials. This includes design of conveyor systems, enclosures, conveyor belt scrapper locations and selection of other loading equipment. Monitoring methods and contingency arrangements are to be included in the River Transport Management Plan and Emergency Preparedness Plan (*CoCP Part A* Section 8).

l. The lighting, to be specified in a Lighting management plan, would be designed to comply with relevant standards. The lighting design needs to consider the aquatic environment and avoid direct lighting of watercourses, where reasonably practical, to avoid inhibiting movements of photophobic species such as eel (*CoCP Part A* Section 4). See para 5.2.7 for CoCP Part B measures relevant to lighting at Kirtling Street.

5.2.7 The *CoCP Part B* at Kirtling Street commits to the following measures that are of relevance to aquatic ecology:

a. The lighting would address the impact on terrestrial and aquatic ecology and include the use of low level directional lighting where possible whilst meeting safe working requirements (*CoCP Part B* Section 4).

b. Membrane to be installed between existing river bed and back fill material to prevent contamination of juvenile fish habitat. The areas of foreshore used for temporary works would be restored to similar condition and material prior to the works (*CoCP Part B* Section 11).

c. The construction area around the main tunnel shaft would be covered by an enclosure/building during the main tunnel construction and secondary lining works. The building would have cladding with a specified sound reduction value (*CoCP Part B* Section 6).

d. The site would adhere to standard, extended standard and continuous working hours for the construction of the main tunnel (*CoCP Part B* Section 4).

Environmental design measures

5.2.8 Generic design principles of relevance to aquatic ecology at Kirtling Street are as follows:

a. Light pollution shall be minimised within the sites by using capped, directional and cowled lighting units.

b. No lighting shall be proposed in the water, directed riverward or on the outside of the foreshore structure, unless required for navigational purposes

5.2.9 Design principles of specific relevance to Kirtling Street are as follows:

a. No operational lighting shall be provided except a low level light to the kiosk doors to allow access to be gained for maintenance in hours of darkness.

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 Kirtling 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 Wandsworth), stakeholder responses to *the main report on phase two consultation* and from professional judgment.

5.3.2 Specific comments relevant to this site for the assessment of aquatic ecology are presented here in Vol 14 Table 5.3.1.

Vol 14 Table 5.3.1 Aquatic ecology – stakeholder engagement for Kirtling Street

Organisation	Comment	Response
Local Authority – Wandsworth Borough Council (February 2012)	The impact of dredging may be detrimental to foreshore ecologies and needs to be carried out in accordance with specific timings to avoid detriment to fish populations and in particular the movements of spawning and juvenile fish.	Limited amounts of dredging are anticipated at this site. The magnitude of impact is considered to be negligible (para. 5.5.33)
	Conveyors are expected to be fully enclosed to minimise noise and prevent spillage or material onto the foreshore or into the River	Noted. Measures in the CoCP to minimise noise are detailed in paras 5.2.8 and 5.2.9 above.

Organisation	Comment	Response
	Thames. This is not mentioned in any level of detail at this stage but needs to be raised as an issue.	
	To avoid damage to the foreshore or scour of the riverbed, alternative moorings for relocated house boats should follow a full ecological survey of the new proposed location and be guided by this in terms of appropriateness and necessary mitigations.	The Thames Tideway Tunnel project subject to the DCO application does not include relocation of house boats.
	There would be an opportunity to enhance the river walls for biodiversity if fendering could be attached both vertically and horizontally at this location.	Fendering is proposed at sites where there would be works to the river wall; no such works are proposed at this site and therefore fendering is not proposed.
Environment Agency phase two consultation Response (February 2012)	We support the location of the jetty being in the subtidal area, which will remove the need for dredging and grounding out should not occur, limiting the impact on the foreshore.	Noted. This accords with the proposed works at this site.
Environment Agency (Section 48 response – 2012)	Effects of piling and lighting should be mitigated.	With the measures detailed in the *CoCP* in place to control piling and lighting, no further mitigation is required.

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 has 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. Locations as close to Kirtling Street as possible have been selected. Details of the background and desk study data sets are provided in Vol 2 Section 5.

5.3.5 Surveys for fish and invertebrates were undertaken during October 2010 at Tideway Walk, immediately downstream of Kirtling Street, and May 2011 at Kirtling Street, within the site and within a 100m radius of the site boundary. During these surveys, the intertidal habitats present were recorded. Surveys for juvenile fish were also undertaken at five sampling locations along the tidal Thames six times between May and September 2011, with the nearest sampling location to the site was Chelsea Embankment Foreshore, approximately 1km upstream. Surveys for algae were undertaken at eight sampling locations in May 2012. The nearest location to the site was at the immediately adjacent Heathwall Pumping Station Foreshore, in May 2012. The survey comprised sampling of algae along a vertical transect of the river wall.

Construction

5.3.6 The assessment methodology for the construction phase follows that described in Vol 2 Section 5. The assessment area is the zone which lies within a 100m radius of the boundary of the site. The assessment year for construction effects is Site Year 1, ie, when construction would commence. There are no site specific variations for undertaking the construction assessment of this site.

5.3.7 Section 5.5 details the likely significant effects arising from the construction at the Kirtling Street site. The construction assessment area includes the maximum extent of works, plus a zone of 100m upstream and downstream. The Thames Tideway Tunnel project Heathwall Pumping Station CSO site is located east of the Kirtling Street site. The combined effect of construction at both of these sites is considered for impacts on aquatic ecology due to their very close proximity.

5.3.8 Whilst the Riverlight (Tideway Industrial Estate) mixed use development, located adjacent to the Kirtling Street site, and the development on land at St George’s Wharf, located approximately 900m downstream, both include riverside walkways it is not considered that these would alter the baseline conditions. The same is considered to be true for Riverwalk House, Millbank, some 820m to the north-east, where a stairway linking the river walk with Vauxhall Bridge would be constructed. At Battersea Power Station, 55m upstream of the Kirtling Street site there will be development from 2016. Although parts of the residential development would already be operational during Thames Tideway Tunnel project construction (thus forming part of the base case), it is possible that works including modifications to the existing jetty and adjustment to the existing river wall would be ongoing during Thames Tideway Tunnel project construction works at the Kirtling Street site; therefore this part of the project is considered within the cumulative effects section of this assessment.

5.3.9 All other developments listed in the site development schedule (Volume 14 Appendix N) 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. Similarly, there are no other schemes under construction which would be in-river, adjacent to the river or discharging to the river, and therefore no further schemes are included in the cumulative assessment.

5.3.10 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.

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 It has been assumed that:

a. vibro-piling would be used

b. the jetty would be constructed from tubular steel piles, and the deck would be a reinforced concrete slab

c. there would be localised dredging for the relocated jetty.

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 effects on 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 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) [4]. 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 or Local Nature Reserves) designated for aquatic ecology within the assessment area.

5.4.6 Kirtling Street falls within the non-statutory River Thames and Tidal Tributaries Site of Importance for Nature Conservation (SINC Grade III of Metropolitan importance)[ii]. The SINC is designated by the Greater London Authority and adopted by all Boroughs which border the tidal Thames. It recognises the range and quality of estuarine habitats including mudflat, shingle beach, reed beds and the river channel itself. The SINC citation notes that over 120 species of fish have been recorded in the Tideway, though many of these are only occasional visitors. The more common species include dace (*Leuciscus leuciscus*), bream (*Abramis brama*) and roach (*Rutilus rutilus*) in the freshwater reaches (described in para. 5.4.9), and sand-smelt (*Atherina presbyter*), flounder (*Platichtyhys flesus*) and Dover sole (*Solea solea*) in the estuarine reaches. Important migratory species include Twaite shad (*Alosa fallax*), European eel, smelt, salmon (*Salmo salar*) and sea trout (*Salmo trutta*). A number of nationally rare snails occur, including the swollen spire snail *Mercuria confusa*, as well as an important assemblage of wetland and wading birds.

5.4.7 The tidal Thames is the subject of a Habitat Action Plan (HAP) within the London Biodiversity Action Plan (BAP) (Thames Estuary Partnership Biodiversity Action Group, undated)[5]. There is no BAP at the Borough level for Wandsworth; therefore the Borough follows the London BAP. The tidal Thames HAP identifies a number of habitats and species which characterise the estuary, such as gravel foreshore, mudflat and saltmarsh. A number of these habitats and species, including mudflat, are also the subject of action plans under the UK BAP.

5.4.8 The river is divided into three zones within the tidal Thames HAP; freshwater, brackish and marine (Vol 3 Figure 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 Kirtling Street lies within the freshwater zone, which means that the fish and invertebrate communities which occur within the river at this location consist of freshwater species and more freshwater tolerant marine species. Invertebrate diversity is generally higher than in the brackish zone but species must be able to withstand some variations in salinity and a stressful environment. Stress is caused by the fluctuating tidal conditions, which means that flora and fauna have to be able to tolerate wide variations in their physical environment.

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

5.4.10 A summary of habitat types present, and other features of interest recorded during surveys are presented in Vol 14 Table 5.4.1. The survey area is presented in Vol 14 Figure 5.4.1 (see separate volume of figures).

Vol 14 Table 5.4.1 Aquatic ecology – Principal habitat, substrate and other features of interest at Kirtling Street

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 Mudflats	Pebbles (70%) Silt (15%) Sand, cobbles (15%)	Sand Silt Gravel

5.4.11 The foreshore around the Kirtling Street survey site is predominantly a mixture of gravel (10-20mm) and pebbles (40-100mm) with frequent cobble stones (150-250m) overlying a compacted silt layer. Local features of significance as habitat include large expanses of mud which cover the gravel foreshore either side of the crane jetty adjacent to the refuse transfer station at the up-stream end of this survey site. This jetty (c.60m in length) extends into the channel up to the low water line, parallel to the embankment and is supported by wooden piles.

5.4.12 The intertidal habitat is relatively narrow in this section of the river (approximately 15m wide) due to development on either bank. The intertidal habitat is classified as the priority habitat mudflat according to Natural England (Natural England, undated)[6].

Evaluation of designations and habitats for Kirtling Street

5.4.13 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

5.4.14 Records compiled by the Zoological Society of London for 2003 – 2011 indicate that harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey seal (*Halichoerus grypus*) and common seal (*Phoca vitulina*) migrate through the Tideway. However the mean number of sightings of mammal species close to the foreshore at the Kirtling Street site is less than one individual per annum.

Evaluation of marine mammals for Kirtling Street

5.4.15 The site is considered to be of low-medium (local) value for marine mammals given the small number of records of seals and porpoises. There are no records to suggest that the site is used as a haul out for seals.

Fish

5.4.16 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 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

5.4.17 Two days of survey were undertaken at this site; one in October 2010 at Tideway Walk located immediately downstream of Kirtling Street, and the second in May 2011 at Kirtling Street. Full details of the methodology and rationale for timing of surveys are presented in Vol 2 Section 5. The area covered by the survey is illustrated in Vol 14 Figure 5.4.1 (see separate volume of figures.)

5.4.18 Fish are routinely categorised into 'guilds' according to their tolerance to salinity and habitat preference (Elliot and Taylor, 1989[7], Elliot and Hemingway, 2002[8]) which can be defined as follows:

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

b. Estuarine resident – species which remain in the estuary 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.

5.4.19 The October 2010 survey at Tideway Walk recorded reasonable fish abundance, with 86 individuals captured in total. The range of species recorded and the number of individuals is presented in Vol 14 Table 5.4.2. Seven species were identified, the majority being bream and roach.

Vol 14 Table 5.4.2 Aquatic ecology – results of fish surveys at Tideway Walk (October 2010)

Common name	Scientific name	Number of individuals	Guild
Common bream	*Abramis brama*	34	Freshwater
Roach	*Rutilus rutilus*	22	Freshwater
Smelt	*Osmerus eperlanus*	15	Diadromous
Flounder	*Platichthys flesus*	7	Estuarine resident
Dace	*Leuciscus leuciscus*	4	Freshwater

Common name	Scientific name	Number of individuals	Guild
Sea bass	*Dicentrarchus labrax*	2	Estuarine resident
Eel	*Anguilla anguilla*	2	Diadromous

5.4.20 The Kirtling Street site was surveyed during May 2011. Five species were identified, the majority of which were bream and roach. The range of species and number of individuals recorded in this survey are presented in Vol 14 Table 5.4.3.

Vol 14 Table 5.4.3 Aquatic ecology – results of fish surveys at Kirtling Street (May 2011)

Common name	Scientific name	Number of individuals	Guild
Common bream	*Abramis brama*	15	Freshwater
Smelt	*Osmerus eperlanus*	4	Diadromous
Dace	*Leuciscus leuciscus*	1	Freshwater
Flounder	*Platichthys flesus*	5	Estuarine resident
Roach	*Rutilus rutilus*	46	Freshwater

5.4.21 In total, 71 fish were caught from the river adjacent to the Kirtling Street site in May 2011. Total catch between this survey site and Thames Tideway Walk site (autumn 2010) is reasonably similar. Although total catch may be comparable the species composition of both catches was different. Sea bass (*Dicentrarchus labrax*) and eels were both absent from the May 2011 sample and numbers of smelt were also lower. Roach however appeared to be more abundant at Kirtling Street in May 2011 with a greater proportion of these individuals being of the juvenile age class. This may suggest an under-representation of this group in the October 2010 survey. The high numbers of coarse fish caught at this survey site (relative to others in both surveys) suggests that this area is preferentially utilised by coarse fish. This may be due to the numerous permanent moorings and structures in this area creating slack-waters and refuge areas. Fish forming localised shoals in areas such as these, which are inaccessible to the seine net, may result in an under representation of age-classes or species in the sample.

5.4.22 The distribution of salinity- sensitive species may shift seasonally and from year-to-year, depending on fluvial inputs, so that community composition may vary. There is relatively high salinity at this mid-tidal Thames location, which is towards the downstream end of the freshwater zone (see Vol 3 Figure 5.4.1, see separate volume of figures), where salinity is relatively close to the tolerance threshold of freshwater species. However, freshwater dace, common bream and roach are known to be present in the tidal Thames from Teddington to Thamesmead, extending further downstream in wetter years. Although only four dace (a freshwater species) were recorded at Tideway Walk in October 2010 and one was recorded at Kirtling Street in spring 2011, EA WFD data obtained during the desk study do indicate that adult dace are known to utilise this stretch of river.

5.4.23 The site is upstream of favoured areas for marine fish species, which explains the small number of such species other than smelt. Post-larval and juvenile fish of these species are known to move upstream during summer (Colclough *et al*, 2002)[9]. Individuals may be present year-round.

5.4.24 Smelt is a species listed under Section 41 of the Natural Environment and Rural Communities Act 2006 and is a priority UK BAP species. Colclough *et al (*Colclough et al, 2002*)*[10] have identified smelt spawning sites on gravel shores in the tidal Thames, including around Battersea and Wandsworth. The spawning period is March-April and thereafter smelt drift progressively downstream from spawning sites towards Greenwich. Catches may be expected along the tidal Thames. The site falls within the zone where tidal Thames smelt are thought to spawn, though the high sediment composition of the mudflats on the foreshore would render it less suitable than other locations for smelt spawning.

Juvenile fish surveys

5.4.25 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.

5.4.26 Surveys for juvenile fish were undertaken at Chelsea Embankment foreshore as part of a suite of five sites sampled six times between May and September 2011 as part of the project-wide effects assessment. The data from Chelsea Embankment foreshore are indicated in Vol 14 Table 5.4.4.

5.4.27 Chelsea Embankment foreshore was the closest survey location to Kirtling Street, and lies approximately 1km upstream. The findings are relevant to this site because it gives context to the assemblage of fish that may be expected to be found in this reach of the river. The site locations are presented in Vol 2 Figure 5.4.4 (see separate volume of figures). The aim of the surveys was to record juvenile fish migrations through the tidal Thames to inform a study of the hydraulic effects of the temporary and permanent structures on fish migration. The extent of the surveys and details of the methodology are presented in Vol 2 Section 5.

Vol 14 Table 5.4.4 Aquatic ecology – results of 2011 juvenile fish surveys at Chelsea Embankment Foreshore

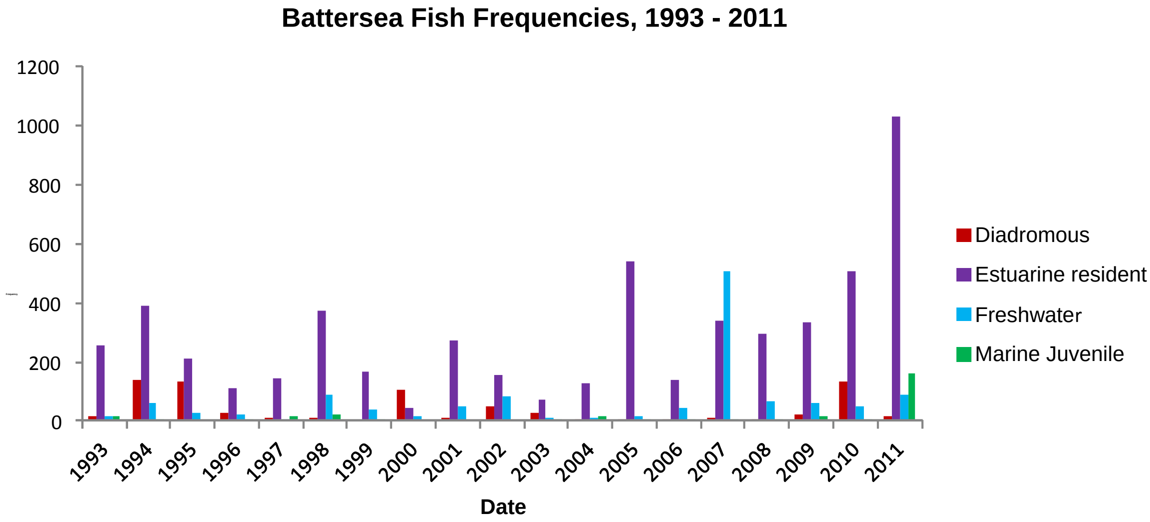
Common name	Scientific name	Number of individuals					
		Survey 1 May	2 late May	3 June	4 July	5 Aug	6 Sept
Flounder	*Platichthys flesus*	10	375	98	3	1	2
Smelt	*Osmerus eperlanus*	0	0	0	0	0	2
Eel	*Anguilla anguilla*	3	2	5	1	1	2
Common bream	*Abramis brama*	0	0	0	3	0	4
Dace	*Leuciscus leuciscus*	2	2	1	0	0	0
Roach	*Rutilus rutilus*	0	0	30	0	0	1
Perch	*Perca fluviatilis*	0	25	3	0	0	0
Goby	*Pomatoschistus* spp.	0	0	38	472	369	470
Sea bass	*Dicentrarchus labrax*	0	0	6	162	149	23
3-spined stickleback	*Gasterosteus aculeatus*	0	0	5	1	0	2
Sand smelt	*Atherina presbyter*	0	0	0	0	2	0

5.4.28 Post-larval flounders (*Platichthys flesus*) dominated the catch from surveys two and three confirming a widespread upper estuary colonisation. Goby numbers (*Pomatoschistus* spp.) increased considerably from survey four onwards, peaking at 472 individuals in survey four. Sea bass numbers also increased in surveys four and five. The survey area results indicate that the area is of importance for juvenile fish as a nursery area, which is an area spatially segregated from adult habitats, providing refuges and a ready food supply for juveniles. The intertidal and sub-tidal gravel habitat may offer a spawning substrate for smelt, although it lies downstream of the spawning zone for this species.

Environment Agency background data

5.4.29 The surveys described in paras. 5.4.17 to 5.4.28 provide up-to-date baseline information directly relevant to fish community composition at Kirtling Street. EA records have also been used to provide a wider context for the fish community in the tidal Thames. The EA data for Vauxhall (the nearest EA sampling site located approximately 1km downstream) are limited to 1992 and 1993 records of juvenile dace and bass. A more comprehensive survey dataset exists for Battersea, located approximately 3.8km upstream, where EA surveys have been carried out every year from 1993 to 2011. Fifteen fish species are recorded for Battersea. These show fairly steady catches from trawls but some indication of increasing seine-net catches in recent years. Catches are dominated by estuarine resident fish (Vol 14 Plate 5.4.1) such as common goby, flounder and sand-smelt, freshwater species including dace, common bream, perch (*Perca fluviatilis*) and roach, and migratory species including eel and smelt. Other migratory species such as salmon and sea trout must pass through the area but are too infrequent to be detected by only one or two surveys per year. These data concur well with the Tideway Walk and Kirtling Street data gathered for this assessment. 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 survive.

Vol 14 Plate 5.4.1 Aquatic ecology – long term EA total fish catches from Battersea site



Water quality and current fish baseline

5.4.30 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)[11] 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.

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

5.4.32 The Tideway Fish Risk Model (TFRM) was developed to evaluate DO standards for the tidal Thames (Turnpenny *et al*., 2004)[12] 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 EA's automated water quality monitoring system (AQMS), for which DO data are collected continuously.

5.4.33 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, fish populations will be sustainable provided hypoxia related mortality does not exceed 10% of the total population. The model considers both adult and juvenile fish (known as 'lifestage cases'), since juveniles generally have a lower tolerance to hypoxia.

5.4.34 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 effects assessment (Vol 3 Section 5.6). However, TFRM results for the existing baseline suggest that a total of five of the seven species/lifestage cases are expected to suffer unsustainable hypoxia related mortality in the tidal Thames each year. Given that the indicator species used in the model act as surrogates for a wider range of ecosystem components, other sensitive taxa are also likely to be unsustainable under this water quality regime.

Evaluation of fish community for Kirtling Street

5.4.35 The Kirtling Street site is considered to be of medium-high (metropolitan) value for fish. This valuation is supported by the assemblage of freshwater and estuarine fish species recorded at the site.

Invertebrates

5.4.36 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.

5.4.37 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

5.4.38 A single day survey was undertaken at Tideway walk, located immediately downstream of Kirtling Street in October 2010. A single day survey was undertaken at Kirtling Street in May 2011. The area covered by the survey is the same as that described for the fish survey (paras. 5.4.17 to 5.4.28) and illustrated in Vol 14 Figure 5.4.1 (see separate volume of figures). Details of the sampling methods used can be found in Vol 2. Three intertidal and two sub-tidal samples were taken for each survey in 2010 and 2011

5.4.39 The invertebrates collected during the October 2010 field surveys are presented in Vol 14 Table 5.4.5. The invertebrates collected during the May 2011 field surveys are presented in Vol 14 Table 5.4.6. The Community Conservation Index (CCI) score (Chadd and Extence, 2004)[13] 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[14], Shirt, 1987[,15]) 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 14 Table 5.4.5 Aquatic ecology – invertebrate fauna sampled at Tideway Walk (October 2010)

Taxa	CCI Score	No. of individual – subtidal samples		No of individual – intertidal samples		
	Sample Numbers	Air Lift 1	Air Lift 2	Kick Sample	Sweep net 1	Sweep net 2
Theodoxus fluviatilis	3	2	0	2	2	5
Potamopyrgus antipodarum	1	24	750	0	22	42
Radix balthica	1	1	8	1	15	34
Corbicula fluminea	-	5	1	0	1	0
Oligochaeta	-	59	85	8	650	1000
Erpobdella sp.	-	0	0	0	2	0

Taxa	CCI Score	No. of individual – subtidal samples		No of individual – intertidal samples		
	Sample Numbers	Air Lift 1	Air Lift 2	Kick Sample	Sweep net 1	Sweep net 2
Erpobdella damaged	-	1	0	0	0	0
Erpobdella testacea	5	0	1	0	1	5
Crangon crangon	-	0	17	0	2	0
Eriocheir sinensis	-	0	2	0	0	0
Apocorophium lacustre	8	2	300	0	60	280
Gammarus zaddachi	1	1	97	5	300	350
Number of taxa	-	**8**	**9**	**4**	**8**	**8**

Vol 14 Table 5.4.6 Aquatic ecology – invertebrate fauna sampled at Kirtling Street (May 2011)

Taxa	CCI Score	No. of individuals - subtidal samples		No. of individuals - intertidal samples		
		Air lift1	Air lift 2	Kick sample	Sweep net 1	Sweep net 2
Theodoxus fluviatilis	3	0	1	0	0	0
Potamopyrgus antipodarum	1	1	38	0	3	2
Radix balthica	1	2	1	0	0	0
Ancylus fluviatilis	1	0	1	0	0	0
Corbicula fluminea	-	0	1	0	0	0
Polychaeta	-	5	1	0	90	0
Oligochaeta	-	0	380	3	52	26
Crangon crangon	-	0	0	0	1	8
Gammarus sp.	-	16	0	0	5	5
Gammarus zaddachi	1	0	140	0	0	0

Taxa	CCI Score	No. of individuals - subtidal samples		No. of individuals - intertidal samples		
		Air lift1	Air lift 2	Kick sample	Sweep net 1	Sweep net 2
Number of taxa	-	4	8	1	5	4

5.4.40 The invertebrate fauna of the Tideway Walk site is characterised by abundant common and pollution tolerant groups (*Radix balthica, Oligochaeta, Erpobdella* and *Potamopyrgus*). As at other sites, some moderately pollution sensitive groups were also present (*Gammarus* sp. and *Corophium*), although the river neritid (*Thedoxus fluviatilis*) was much less abundant than other similar sites. There was little significant difference between the different samples taken that might indicate local differences in habitat or water quality.

5.4.41 Chinese mitten crab (*Eriocheir sinensis*) and Asiatic clam (*Corbicula fluminea*), both non-native, invasive species, were sampled in the subtidal zone of the site.

5.4.42 Sub-tidal and intertidal samples taken at Kirtling Street survey site were characterised by moderate to low invertebrate diversity, except in one of the sub-tidal samples (air lift 2). Pollution tolerant taxa such as the New Zealand mudsnail *Potamopyrgus antipodarum*, Oligochaeta and Polychaeta worms dominated the invertebrate community, while more sensitive taxa, such as the river neritid *T. fluviatilis* were recorded in very low abundances. This poor quality is likely to be explained by poor water quality and habitat disturbances.

5.4.43 No significant differences appear between the intertidal and subtidal samples, either in terms of diversity or in terms of abundances of the species present.

5.4.44 As at other survey sites, the taxa present were brackish species, with varying tolerance of different levels of salinity from estuarine to near freshwater, and the presence of brown shrimp *Crangon crangon* and Polychaeta worms reflects the brackish nature of the water at this survey site.

5.4.45 None of the species present were of high nature conservation importance, as demonstrated by their low CCI scores.

Environment Agency (EA) background data

5.4.46 Battersea has been regularly sampled by the EA since 2005 and it is the nearest regular EA sampling site for invertebrates. The EA samples are taken using a number of techniques, including cores and kick sampling in the intertidal and day grab and core samples in the subtidal.

5.4.47 A total of 50 taxa were recorded at Battersea over the seven year period in which samples were collected. The taxa Oligochaeta (worms), which thrives in organically polluted conditions, was relatively abundant, together with other pollution tolerant species such as the snail *P. antipodarum*. However, *Gammarus zaddachi*, a moderately pollution-sensitive species was also highly abundant and *T. fluviatilis* (pollution sensitive river neritid) was present most years.

5.4.48 All of the taxa present were brackish species or animals that have a varying tolerance to different levels of salinity from estuarine to near freshwater. No obligate freshwater or marine animals were present. The occasionally brackish nature of the water is demonstrated by the presence of species such as *G. zaddachi* (a brackish species of shrimp, rather than its more commonly occurring freshwater homologue *Gammarus pulex*) and *C. crangon* (shrimps, typical of estuarine and brackish conditions).

5.4.49 The CCI score has been used to assess whether any species of nature conservation importance are present.

5.4.50 The only species of high nature conservation importance was the mudshrimp *Apocorophium lacustre* (CCI 8), a RDB species, which was present at the EA sampling site at Battersea. 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.

5.4.51 The zebra mussel (*Dreissena polymorpha*) was present in EA sampling at Battersea. It is a non native invasive species that can establish in densities that crowd-out native invertebrates. It also colonises shells of native species, reducing the ability of the 'host' to feed and burrow.

5.4.52 Other non native species included the Asiatic clam and the amphipod shrimp *Gammarus tigrinus*. This species of amphipod, which arrived in English waters via ballast water from ships, 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.

Water quality and current invertebrate baseline

5.4.53 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. The analysis is presented in Vol 3 Appendix C.5. 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 Tideway Walk/ Kirtling Street are indicative of polluted conditions because they are able to tolerate the low DO conditions and multiply rapidly in the enriched sediments.

5.4.54 The analysis is described in further detail in Vol 3 Section 5.4. The following summary is relevant to the freshwater zone of the tidal Thames in which the Kirtling Street site is located.

5.4.55 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)[16]. 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.

5.4.56 Redundancy analysis (RDA)[iii] was used to compare the invertebrate dataset with water quality data for the period between 1992 and 2011. The analysis demonstrated the importance of environmental variables in determining the invertebrate communities in the tidal Thames. It appears that dominance of either Gammaridae (sensitive to hypoxia) or Oligochaeta (more tolerant to hypoxia) is influenced by the DO concentrations and DO sags in the Thames, although other factors such as habitat are also highly important. Other invertebrate taxa also appeared to be affected by poor water quality (low DO) and/or saline intrusion, notably the insect group (mayflies), while other groups (essentially Polychaete and Oligochaete worms) were shown to be tolerant of these conditions.

Evaluation of invertebrate community for Kirtling Street

5.4.57 The Kirtling Street site is considered to be of medium (borough) importance due to the dominance of the invertebrate community by a limited range of pollution tolerant species. Whilst of limited conservation value, the invertebrate community enriches the borough habitat resource.

Algae

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

5.4.59 A single day survey was undertaken in May 2012 at Heathwall Pumping Station foreshore, located immediately downstream of the Kirtling Street site. All records are shown in Vol 14 Table 5.4.7.

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

Vol 14 Table 5.4.7 Aquatic ecology – marine algae sampled at Heathwall Pumping Station foreshore

Species	Survey observations	Species presence within the Thames estuary
Blidingia minima	Dominant in the upper zone of the river wall.	Abundant in tidal Thames.
Cladophora glomerata	Frequently present on the lower zone of the river wall.	Widespread and abundant.
Rhizoclonium riparium	Frequently present on the lower zone of the river wall.	Common in the estuary.
Ulva prolifera	Occasionally present on the river wall.	Widespread in the estuary.
Vaucheria sp.	Occasionally present on the river wall.	The *Vaucheria sp* recorded is most probably *Vaucheria compacta*, which occurs on the upper littoral levels on sea walls. Widespread in the tidal Thames.
Bangia atropurpurea	Occasionally present near the foot of the wall.	Recorded sporadically on river walls since 1975.

Natural History Museum background data

5.4.60 Data were obtained from the Natural History Museum, London (NHM) that identifies records of marine algae received for the period from the early 1970s to 1999. However, the data only covers a small number of sites and none are in the vicinity of Kirtling Street. There are therefore no data regarding algae at this site. The nearest site where data is available is Chelsea Bridge, approximately 500m upstream of Kirtling Street. The records are all shown in Vol 14 Table 5.4.8.

Vol 14 Table 5.4.8 Aquatic ecology – marine algae sampled at Chelsea Bridge between early 1970s and 1999

Species	Relevant Text
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.

Species	Relevant Text
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.
Rhizoclonium riparium	Upper mid-littoral levels on sea walls and occasionally on floating structures above the water-line. Common in the estuary.
Vaucheria compacta	Upper littoral levels on sea walls. Common in the estuary.

Water quality and algal communities

5.4.61 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 (see para 5.1.3). This process is known as eutrophication. Excessive levels of algae can disrupt other elements of the ecosystem by smothering them.

5.4.62 Studies of the pelagic algae (para 5.4.58) 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)[17]. However, historically poor water quality has had a considerable adverse influence on the algal communities of the tidal Thames and the loss of pollution sensitive species. Improvements in sewage treatement since the 1960's have lead to a gradual process of recovery (Tittley, 2009)[18], although pollution tolerant species such as the green algal species still dominate the community.

Evaluation of algal community for Kirtling Street

5.4.63 None of the species recorded in Vol 14 Table 5.4.7 and Vol 14 Table 5.4.8 have protected or notable status (e.g. 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

5.4.64 Using the baseline set out in paras. 5.4.1 to 5.4.63 the value accorded to each receptor considered in this assessment is set out in Vol 14 Table 5.4.9.

5.4.65 The definitions of the receptor values and sensitivities used in this evaluation are set out in Vol 2 Section 5.

Vol 14 Table 5.4.9 Aquatic ecology – summary of receptors and their values/sensitivities during construction at Kirtling Street

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

Construction base case

5.4.66 The base case in Site Year 1 of construction 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 will be a considerable reduction in the occurrence of mass or population level fish mortalities with these schemes (i.e. 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. Given that CSOs within the tidal Thames would continue to spill and no significant changes in habitat quality are anticipated the fish baseline for the Kirtling Street site may therefore be expected to support a similar assemblage of species to the current baseline, with potentially a greater number of pollution sensitive species and life stages. Recovery due to water quality improvements will, however, be at an early stage.

5.4.67 The invertebrate analysis demonstrates that more pollution sensitive groups such as shrimps (Gammaridae) are subject to considerable fluctuations in abundances during low DO periods. With the improvements associated with the Lee Tunnel scheme and sewage treatment works upgrades, 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 freshwater zone, including Kirtling Street would continue to be suppressed. As for fish, recovery of the invertebrate communities would be at an early stage. 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 paras 5.4.58 to 5.4.63. No changes in marine mammals are anticipated as they are relatively insensitive to point source sewage discharges.

5.4.68 There is unlikely to be encroachment onto the River Thames foreshore for non-river dependent uses as this is restricted through *London Plan 2011* (Greater London Authority, 2012)[19] 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* (EA, 2005)[20] 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 the current baseline from other developments is considered likely.

5.5 Construction effects assessment

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

Construction impacts

Temporary landtake

5.5.2 There would be a total of approximately 45m^2 of temporary landtake associated with the steel piles supporting the jetty and conveyors. This represents 0.0002% of the River Thames and Tidal Tributaries SINC (Grade M). As already stated, it is assumed for the purposes of the assessment that removal of the jetty would involve cutting the piles off at the surrounding foreshore level or removal if reasonably practical. The structures would be in place for a total of five and a half years, which is therefore the duration of this temporary landtake.

5.5.3 Given the small amount of direct landtake involved, the impact is considered to be negligible. The probability of the impact occurring is considered to be certain.

Sediment disturbance and compaction

5.5.4 There would be a zone of approximately 1ha outside the area physically occupied by the piles which would be affected by installation of the piles during a period, assumed for the purposes of the assessment to be approximately six weeks in Site Year 1. The jack up barge would be used to facilitate driving the piles into place, thus affecting intertidal and subtidal habitat.

5.5.5 Barges are not expected to 'ground out', even on the lowest spring tide, and so there would be no further compaction beyond that caused by the jack up barge.

5.5.6 Disturbance impacts on intertidal and subtidal habitats are considered to be low adverse, probable and temporary.

Shading of the river

5.5.7 The presence of the temporary jetty and conveyors to facilitate processing and handling of excavated material would result in temporary shading of the section of river which lies beneath. However, there is relatively little intertidal habitat in this area (approximately 975m^2) and none of it consists of emergent vegetation (such as saltmarsh) that would be potentially very susceptible to shading. Overall therefore the impact is considered to be negligible, certain and temporary.

Spillage of light from construction compound into surrounding riverine habitats

5.5.8 Light spillage into the water column has the potential to cause disturbance to fish. During construction the site would be operated 24hrs for the tunnelling and secondary lining tunnel works. As stated in para. 5.2.6 the *CoCP* indicates that lighting of the construction site would be managed via a *Lighting management plan*. It has been assumed that flood lighting or similar would be designed such that it would be directed into the site or shielded to minimise illumination of the water. The extent of light spillage is therefore anticipated to be very limited, and it would be of short duration, especially during the summer months. The impact is therefore considered to be negligible, probable and temporary.

Change to the flow velocity

5.5.9 Some limited changes to the hydrodynamic regime in the intertidal zone may result from the presence of the piers that would support the jetty and conveyors. However, any such changes are likely to be either neutral or slightly beneficial since the velocity of the water would slow down around the piers resulting in slack water that may aid fish movement. The impact is considered to be negligible, probable and temporary.

5.5.10 It is assumed for the purpose of the assessment that at least one barge is likely to be present at the jetty at all times during years one to five of construction. Hydrodynamic modelling of the temporary and permanent structures suggests that there would be no hydraulic effects associated with the barges. Given the close proximity between Kirtling Street and the cofferdam construction at Heathwall Pumping Station (Volume 15) there is potential for combined impact on hydrodynamic flow to be experienced. However, since the Kirtling Street site only involves jetty pile installation, this is considered negligible.

Waterborne noise and vibration

5.5.11 There would be approximately 70 steel cylinders piled into the foreshore and subtidal zone. Piles would be driven using vibro piling techniques, thus limiting the principal source of waterborne noise and vibration impacts. In addition there would be a small degree of vibration through the piles during operation of the conveyors. Further measures to limit noise and vibration impacts during the construction stage of the project have been incorporated into the *CoCP*. These are described in para. 5.2.6 of this volume.

5.5.12 Noise and vibration have the potential to cause physical damage to fish, and disrupt behaviour. However, in this case, given the piling techniques proposed and the extent of the works relative to the width of the channel this is considered to be a low negative impact, probable and temporary. Given the close proximity between Kirtling Street and the cofferdam construction at Heathwall Pumping Station (Volume 15) there is potential for combined impact of noise and vibration to be experienced. However, since the Kirtling Street site only involves jetty pile installation, this is considered negligible.

Increase in suspended sediment loads

5.5.13 Piling operations are likely to lead to localised increases in suspended sediment with the potential for effects on local and downstream habitats. This could lead to increased levels of suspended solids, and potentially contaminants, into the river.

5.5.14 Chemical analysis of sediment within the foreshore at this site has identified that levels of heavy metals, poly aromatic hydrocarbons (PAH) and other contaminants are below the Probable Effects Level (the concentration above which adverse effects are most likely to occur if sufficient exposure takes place). As such impacts related to mobilisation of contamination can be discounted.

5.5.15 There would be small quantities of sediment liberated during piling installation and during the small amount of dredging required; however these would be negligible compared to the 40,000 tonnes (or 20,000m^3 assuming an in-situ density of 2t per m^3) of sediment (HR Wallingford, 2006) [21] that are carried on a spring tide. In this context, the volumes produced by the construction works would not be detectable against natural fluctuations in sediments and would not have an impact on surface water resources (HR Wallingford, 2012)[22.] Impacts are considered to be negligible, probable and temporary.

5.5.16 Measures and safeguards to minimise the risk of accidental releases of silty or contaminated discharges to the tidal Thames are included in the *CoCP* Part A. These are described in para 5.2.6. No impacts from polluted discharges are anticipated provided these control measures and safeguards are in place.

Construction effects

5.5.17 This section (paras. 5.5.18 to 5.5.45) 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.

Designations and habitats

Loss of intertidal and subtidal habitat due to temporary landtake

5.5.18 There would be a temporary loss of approximately 45m^2 of intertidal and subtidal habitat, from the jetty and conveyor piles. The intrinsic value of the habitats (i.e. the inherent value of the habitat as an ecological feature in itself, rather than simply in terms of the support it provides for fauna) in this area is considered to be relatively low. However, they are considered to be of metropolitan importance as part of the River Thames and Tidal Tributaries SINC (Grade M). Sediment is expected to naturally and quickly accrete to cover the bases of the jetty piles once they are cut off at bed level (or removed) for jetty removal. The overall effect is considered to be **negligible** given the negligible impact magnitude and value of the receptor.

Disturbance and consolidation of intertidal and subtidal habitat

5.5.19 There would be disturbance and compaction of approximately 1ha outside the jetty area for a period of approximately 8 weeks in Site Year 1 as the jetty and conveyors are established by a jack-up barge. The jack-up barge may also be used to remove the piles once construction is complete. The effect is considered to be **minor adverse** due to the limited area affected by compaction combined with the temporary nature of the low negative impact on a receptor of medium-high (metropolitan) value.

Marine mammals

Interference with the migrations of marine mammals within the Tideway

5.5.20 Noise, vibration and lighting have the potential to disturb mammals and deter them from passing the site. However, given the low negative impact and localised extent of any lighting, the piling methods used, the duration of the period when piling would be taking place, and the controls on underwater noise-generating activities described in the *CoCP*, Part A (para. 5.2.6), this is considered to be a **negligible** effect on a low-medium (local) value receptor.

Fish

Loss of feeding, resting and nursery habitat for fish due to temporary landtake

5.5.21 The very small amount of landtake would result in very little loss of habitat for fish, and the impact is considered negligible. The effect on fish is therefore considered to be **negligible** given the impact magnitude and medium-high (metropolitan) value of the receptor.

Temporary shading of intertidal and subtidal feeding and resting habitat for fish

5.5.22 There is relatively little intertidal habitat at the site and there is no marginal habitat (such as saltmarsh or reed bed) that would be potentially very susceptible to shading. The intertidal mudflat is likely to support communities of microalgae used as a feeding resource by fish, and this may be affected by reduced light levels. However, given the limited area of the jetty, and the availability of similar feeding habitat elsewhere, the effect is considered to be **negligible** given the negligible impact magnitude and medium-high (metropolitan) value of the receptor.

Potential disturbance due to illumination of the river

5.5.23 Although fish behaviour can be altered through lighting, the illumination associated with the 24 hour construction would be primarily land-side and directed away from the river. Illumination of the river is likely to be highly localised in extent. Since it is considered an impact of negligible magnitude on a receptor of medium-high (metropolitan) value would result in a **negligible** effect.

Interference with the migratory movements of fish

5.5.24 Ideally, the river channel should provide an uninterrupted route for juvenile fish migrations for species such as eel as glass eels or elvers, dace, goby and flounder as they move through the estuary.

5.5.25 In general, encroachment of structures into the river channel may affect the river hydraulics, particularly at high discharges associated with heavy fluvial inputs or spring tides. Changes in water velocity caused by constriction of the hydraulic channel may hinder movements of fish against the tide, including their ability to withstand, or hold station in the flow. Constriction of the hydraulic channel, reduction of the intertidal zone and increased water velocities might cause some fish to be lost, for example by forcing them into deeper water with increased predation risk. Formation of eddy currents in the wake of structures may temporarily entrap fish and delay progress of migrations. Persistently delaying the successful migrations of fish past individual sites may also interfere with key life stage events such as spawning through preventing fish from reaching spawning sites at appropriate times.

5.5.26 The jetty and conveyors would be on piled piers and would therefore present a minimal obstruction to juvenile fish as they move through the estuary. Indeed, the water velocity would slow down around each pier thus potentially providing some additional temporary refuge and resting areas for fish.

5.5.27 The Individual Based Modelling (IBM) used to simulate the effects of the temporary and permanent structures on juvenile fish migration demonstrates that the temporary works should benefit upstream migration by presenting more opportunities for fish to shelter from adverse currents. Although the structure would cause juvenile fish to move into deeper water where predation risk is higher, the period of time in which they are exposed to this risk is sufficiently short that the study found it would have no effect on overall mortality rates when compared to the base case. Detail of the study, including the modelling methods, are presented in Volume 3.

5.5.28 Given the temporary nature of the works, and the fact that the jetty and conveyors would be on piled piers, the effects of the temporary structures on juvenile fish migrations are considered to be **negligible** given the negligible impact magnitude and value of the receptor.

Effects of waterborne noise and vibration on fish

5.5.29 The effects of waterborne noise and vibration on fish vary according to the proximity of the receptor to the source. Effects depend on distance from source, ranging from potential death at very close proximities, through injury, and behavioural disturbance with increasing distance from the source.

5.5.30 The driving of the piled piers for the jetty would be undertaken using techniques that minimise the level of noise and vibration. However the total surface area of the piles is small (approximately 45m^2) and the period of piling would be sufficiently brief (assumed for the purposes of this assessment to be approximately 6 weeks). Removal of the piles would take a similar length of time at the end of the construction period. Furthermore a series of control measures relating to the timing and duration of piling operations have been included in the *CoCP* (para. 5.2.6).

5.5.31 The site is not considered to support sensitive spawning habitat, and therefore there is only low receptor sensitivity, as no significant numbers of any fish species would be likely to be present for extended periods. Given the controls on piling noise and vibration, the relatively low proportion of the river cross section that would be affected, the low sensitivity of the habitat and the short duration of piling activity (six weeks), the overall effect is considered to be **negligible** given the negligible impact magnitude and medium-high (metropolitan) value of the receptor.

Blanketing of feeding areas for fish and reduction in water column visibility due to suspended sediment

5.5.32 Although the tidal Thames is a sedimentary environment with high levels of suspended solids, construction activities such as piling has the potential to generate high levels of suspended sediment which may cause disorientation of fish.

5.5.33 Limited dredging would be undertaken at this site. The installation of the piled piers into the sediment would have some limited potential for re-suspended sediments to affect juvenile fish migrations. The effect is considered to be **negligible** given the negligible impact magnitude and medium-high (metropolitan) value of the receptor.

Invertebrates

Direct mortality of invertebrates due to temporary landtake, sediment disturbance and consolidation

5.5.34 There would be direct mortality of invertebrates within sediments removed or covered by the piled piers due to consolidation and disturbance of sediment due to the construction of the jetty in the site setup phase. The effect is considered to be **negligible** due to the small areas of habitat leading to a low adverse impact on a receptor of medium (borough) value.

Loss of burrowing and feeding habitat for invertebrates due to temporary landtake

5.5.35 The area beneath the piled piers of the jetty would be lost as burrowing and feeding habitat during the entire construction period.

5.5.36 The small amount of landtake would result in a minor loss of habitat for invertebrates. The effect on invertebrates is therefore considered to be **negligible** given the negligible impact magnitude and medium (borough) value of the receptor.

Loss of feeding and burrowing habitat for invertebrates due to sediment disturbance and consolidation

5.5.37 The area beneath the piled piers of the jetty would be subject to consolidation in the medium term (1-5 years) following removal of the jetty.

5.5.38 Due to the small area involved, the temporary consolidation and disturbance to the habitat for burrowing invertebrates is considered to be a **negligible** effect given the low negative impact magnitude and medium (borough) value of the receptor.

Temporary shading of intertidal and subtidal feeding and resting habitat for invertebrates

5.5.39 There is relatively little intertidal habitat at the site and there is no marginal habitat (such as saltmarsh or reed bed) that would be potentially very susceptible to shading. The intertidal mudflat is likely to support communities of microalgae which would be used as a feeding resource by invertebrates, and this may be affected by reduced light levels. However, given the limited extent of the jetty area, and the availability of similar feeding habitat elsewhere, the effect is considered to be **negligible**, based on a negligible impact on a receptor of medium (borough) value.

Potential disturbance due to illumination of the river

5.5.40 The illumination associated with the 24 hour construction would be primarily land-side although there would be some lighting of the jetty. Although pelagic invertebrates can be affected by lighting much of the invertebrate interest of the area is benthic and unlikely to be affected by illumination. Since it is considered an impact of negligible magnitude on a receptor of medium (borough) value, this would have a **negligible** effect.

Blanketing of feeding areas for invertebrates due to suspended sediment

5.5.41 Although the tidal Thames is a sedimentary environment with high levels of suspended solids, construction activities such as piling have the potential to generate high levels of suspended sediment which may interfere with the feeding mechanisms of certain invertebrates.

5.5.42 Limited dredging would be undertaken at this site. The installation of piles into the sediment does have some limited potential for re-suspended sediments to smother feeding habitats. However the total surface area of the piles is small (approximately $45m^2$) and the period of piling would be sufficiently brief (assumed for the purposes of this assessment to be six weeks) that the impact would be negligible. Therefore the risk of blanketing of invertebrate habitats is considered to be low and the effect would be **negligible** given the medium (borough) value of the receptor.

Algae

Loss of habitat due to temporary landtake

5.5.43 The location of marine algae at this location is primarily on the river wall itself. The construction of the jetty and conveyors would therefore have a **negligible** effect given the negligible impact magnitude and low-medium (local) value of the receptor.

Blanketing of areas and increase in water column turbidity due to suspended sediment

5.5.44 As stated in para. 5.4.42, the tidal Thames is already a sedimentary environment with high levels of suspended solids. The generation of increased levels of suspended sediment from construction activities may cause smothering of marine algae.

5.5.45 Given the small extent of piling for the piers and short duration, the potential for re-suspended sediments to affect marine algae located on river walls immediately downstream is limited. The value of the receptor is low-medium (local) and the impact considered negligible and therefore the effect is considered to be **negligible**.

Sensitivity test for programme delay

5.5.46 For the assessment of effects on aquatic 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. 5.5.1 - 5.5.45). This is because there are no developments in the site development schedule that would fall into the base case as a result of this delay and therefore the base case would remain as described in paras. 5.4.66 - 5.4.68.

5.6 Operational effects assessment

5.6.1 As stated in para. 5.1.2, there would be no CSO interception at this site or any permanent in-river works, thus no significant operation phase effects on aquatic ecology are anticipated. Therefore the operational phase has not been assessed.

5.7 Cumulative effects assessment

5.7.1 As described in para. 5.3.8, during the construction phase the only scheme within the site development schedule (Vol 14 Appendix N) that would have an impact on aquatic ecology receptors would be the Battersea Power Station scheme located 55m upstream of the Kirtling Street site. During construction of this scheme, there would be works on the jetty that would require both capital and maintenance dredging, and construction of a floating pontoon with steel mono piles. Therefore there could be impacts on aquatic ecology receptors through increased waterborne noise and vibration, and increased sediment loads. The extent and duration of piling at Battersea Power Station would be limited such that effects identified in Section 5.5 from the Kirtling Street site works, namely the minor adverse effects on fish from waterbourne noise and vibration and negligible effects from sediment disturbance on fish and invertebrates, are likely to remain unchanged.

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, while there are construction works scheduled at Battersea Power Station, they are not anticipated to generate significant cumulative effects. A delay to the Thames Tideway Tunnel project would increase the separation in time between the construction at Battersea Power Station and with construction at the Kirtling Street site. For this reason, cumulative effects on aquatic ecology with a programme delay of approximately one year would not change significantly from those described in para. 5.7.1.

5.8 Mitigation

5.8.1 All *CoCP* measures of relevance to aquatic ecology are summarised in Section 5.2. No mitigation is required given the temporary and reversible nature of effects.

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

Construction effects

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

5.10 Assessment summary

Vol 14 Table 5.10.1 Aquatic ecology – summary of construction assessment

Receptor	Description of effect	Significance of effect	Mitigation	Significance of residual effect
Designations and habitats	Loss of intertidal and subtidal habitat due to temporary landtake	Negligible	None	Negligible
	Disturbance and consolidation of intertidal and subtidal habitat	Minor adverse	None	Minor adverse
Mammals	Interference with the migrations of marine mammals within the Tideway	Negligible	None	Negligible
Fish	Loss of feeding, resting and nursery habitat for fish due to temporary landtake	Negligible	None	Negligible
	Temporary shading of feeding and resting habitat for fish	Negligible	None	Negligible
	Potential disturbance due to illumination of the river	Negligible	None	Negligible
	Interference with migratory movements of fish	Negligible	None	Negligible
	Effects of waterborne noise and vibration on fish	Minor adverse	None	Minor adverse
	Blanketing of feeding areas for fish and invertebrates and reduction in water column visibility due to suspended sediment.	Negligible	None	Negligible
Invertebrates	Direct mortality of invertebrates due to temporary land take, sediment disturbance and consolidation	Negligible	None	Negligible
	Loss of feeding/burrowing habitat for invertebrates	Negligible	None	Negligible

Receptor	Description of effect	Significance of effect	Mitigation	Significance of residual effect
	due to temporary landtake.			
	Loss of feeding and burrowing habitat for invertebrates due to sediment disturbance and consolidation.	Negligible	None	Negligible
	Temporary shading of invertebrate habitat	Negligible	None	Negligible
	Potential disturbance due to illumination of the river	Negligible	None	Negligible
	Blanketing of feeding areas for invertebrates due to suspended sediment.	Negligible	None	Negligible
Algae	Loss of habitat due to temporary landtake	Negligible	None	Negligible
	Blanketing of areas and increase in water column turbidity due to suspended sediment	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 14: Kirtling Street site assessment

Section 6: Ecology - terrestrial

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling 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 Kirtling Street site.

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

a. site and vegetation clearance, and habitat reinstatement

b. temporary structures within the foreshore

c. construction and site activities

d. barge movements and associated facilities.

6.1.3 Operational effects for terrestrial ecology for this site have not been assessed. 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 The following are not considered within the assessment:

a. Contaminated runoff and atmospheric pollution, as these would be controlled through the implementation of the *Code of Construction Practice* (*CoCP*).

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

c. The presence of invasive plants listed on Schedule 9 of the Wildlife and Countryside Act 1981 (WCA 1981) as this would be managed in advance of site clearance and by the measures set out in the *CoCP* Part A (Section 11). However, the baseline includes the results of the invasive plants survey (para. 6.4.24).

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 (Vol 14 Kirtling 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.

Construction

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

a. removal of ephemeral short perennial vegetation, introduced shrub and buildings on site

b. construction works throughout the construction phase that would create noise and vibration, such as the use of construction machinery and vehicles, demolition and the tunnel excavation. This includes noise and vibration during 24 hour working

c. artificial lighting of the site in evenings during winter, and continuously during the main tunnel drive and subsequent secondary lining

d. use of barges and the associated jetty on the foreshore, and the subsequent restoration of the foreshore.

Code of construction practice

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

Part A

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

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

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

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 restrictions to working hours

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

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

Part B

6.2.5 The *CoCP* Part B (Section 11) states that areas of foreshore used for temporary works would be restored to a similar condition and material as present prior to the works.

Environmental design measures

6.2.6 No embedded measures to mitigate adverse effects or provide biodiversity enhancements have been incorporated into the project design at this site.

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 Kirtling Street had been identified as a potential site. The scope for terrestrial ecology for this site has therefore drawn on the scoping response from London Borough (LB) of Wandsworth, feedback from biodiversity workshops held with statutory stakeholders, which were attended by LB of Wandsworth officers, phase two consultation and is based on professional judgement as well as experience of similar sites.

6.3.3 There are no specific comments relevant to this site for the assessment of terrestrial ecology.

Baseline

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

a. desk study

b. a Phase 1 Habitat Survey was undertaken on the 7 December 2010 covering the majority of the site with an additional area also surveyed on 20 May 2011

c. bat triggering (remote recording) bat surveys were undertaken over three nights between the 6 and 8 May 2011 in one location adjacent to the tidal Thames, and between 29 September and 1 October 2012 at two locations within an area of buildings to the south of Cringle Street (para. 6.4.10 to 6.4.13)

d. bat activity (dawn) survey was undertaken on the 28 June 2011

e. wintering bird surveys were undertaken on 25 January, 24 February, 25 March, 18 October, 29 November and 13 December 2011

f. black redstart (*Phoenicurus ochruros)* surveys were undertaken on 20 May, 10 June, 21 June, 28 June and 12 July 2011.

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] is given in Vol 2 Section 6.

6.3.7 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.

6.3.8 The assessment considers bats, wintering birds and black redstart 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.

6.3.9 Section 6.5 details the likely significant effects arising from the construction at the Kirtling Street site. The nearby Heathwall Pumping Station Thames Tideway Tunnel project site could give rise to additional effects on terrestrial ecology within the assessment area for this site, therefore has been considered in this assessment.

6.3.10 No change to the base case conditions for terrestrial ecology are considered likely from any proposed developments listed in Vol 14 Appendix N. Those in close proximity to the site would be replacing existing areas of buildings and hardstanding, and landscape planting (where proposed) would be immature. All other development are isolated from the proposed development site, within the urban context.

6.3.11 No likely significant cumulative effects have been identified as the developments listed in Vol 14 Appendix N that would be under construction during the construction phase at the Kirtling Street site are isolated from the proposed development site within the urban context by roads and other buildings.

6.3.12 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

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

Assumptions

6.3.14 It is assumed for the purposes of assessment that the current use (as described in Vol 14 Section 2) of the Kirtling Street site will continue as it is at present: as stated in para. 6.3.11 the development on-site of the Battersea Plant is not considered to constitute a change to the ecological baseline.

Limitations

6.3.15 No site specific limitations have been identified.

6.4 Baseline conditions

6.4.1 The following section sets out the baseline conditions for terrestrial ecology receptors within and around the site, including their value. Future baseline conditions (base case) are also described. All figures referred to in this section are contained in the Vol 14 Kirtling Street Figures.

Current baseline

Designated sites

6.4.2 The following designated sites relevant to terrestrial ecology are within 250m of the site and is shown on Vol 14 Figure 6.4.1 (see separate volume of figures):

a. The site is within and adjacent to the tidal Thames and Tidal Tributaries Site of Importance for Nature Conservation (SINC Grade III of Metropolitan importance[i]) and comprises foreshore habitat and river channel. This designated site is assessed in Section 5 of this volume and is not considered further here.

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

b. Battersea Power Station SINC (Grade II of Borough importance[ii]) approximately 55m to the west of the site, and comprises the historic Battersea Power Station and ephemeral short perennial habitat.

Habitats

6.4.3 Habitats recorded within the survey area during the Phase 1 Habitat Survey are described in Vol 14 Table 6.4.1 below and shown on Vol 14 Figure 6.4.2 (see separate volume of figures). Target notes (TN#) are indicated on this map and are referred to within the text below.

Vol 14 Table 6.4.1 Terrestrial ecology – Phase 1 Habitat Survey

Habitat type / feature of note	Habitat description
Buildings	The buildings on site, to the north of Kirtling Street, are brick built structures surrounded by a high brick wall. Buildings on site, to the south of Kirtling Street, are industrial buildings with made ground used for heavy goods vehicles.
Hardstanding	There is hardstanding at various locations within the survey area in the form of roads and pathways.
Ephemeral/short perennial vegetation	A small area of ephemeral/short perennial vegetation exists in the south eastern corner of the survey area. Species present include black medick (*Medicago lupulina)*, groundsel (*Senecio vulgaris)*, goat's-rue (*Galega officinalis)*, London rocket (*Sisymbrium irio)*, smooth sow-thistle (*Sonchus oleraceus)*, weld (*Reseda luteola)*, mugwort (*Artemisia vulgaris)* and bracken (*Pteridium aquilinum).*
Amenity grassland	There are no areas of amenity grassland on the site. However there are small areas of amenity grassland within the survey area in the south and east (to the south of Nine Elms Lane and near to the Battersea Power Station site).
Introduced shrub	There is a strip of introduced shrub located within the south of the site, including butterfly-bush (*Buddleja davidii),* a hebe (*Hebe sp*.), an Oregon-grape (*Mahonia sp*.), a firethorn (*Pyracantha sp*.), cherry laurel (*Prunus laurocerasus)*, a barberry (*Berberis sp*.), and a cotoneaster (*Cotoneaster sp.).*

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

Habitat type / feature of note	Habitat description
Running water and intertidal zone	A section of the intertidal River Thames lies within the survey area. This habitat type is part of the aquatic ecology assessment (Section 5 of this volume).

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

6.4.5 The ephemeral/short perennial habitat is limited in extent and comprises common plant species. This habitat type does not appreciably enrich the local habitat resource and is considered to be of negligible value.

6.4.6 The introduced shrub comprises non-native species, which tend to have an adverse effect on native habitats and contribute little to the local biodiversity resource. This habitat type is considered to be of negligible value.

Notable species

6.4.7 Survey results are set out in a notable species report, which is included in Vol 14 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

6.4.8 During the Phase 1 Habitat Survey, the tidal Thames, on and adjacent to the site, was identified as being likely to represent an area of importance to commuting bats. Therefore, remote recording surveys and an activity survey at dawn were undertaken at this site.

6.4.9 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 Biodiversity Action Plan (BAP). Nine bat species are listed on the London BAP including common pipistrelle (*Pipsitrellus pipistrellus)*, soprano pipistrelle (*Pipistrellus pigmaeus)*, Nathusius' pipistrelle (*Pipistrellus nathusii)* and noctule (*Nyctalus noctula*). These species were all recorded on site. Detailed survey results are provided in Vol 14 Appendix D.1 and on Vol 14 Figure 6.4.3 (see separate volume of figures).

6.4.10 The remote recording surveys at one location adjacent to the tidal Thames shown on Vol 14 Figure 6.4.3 (see separate volume of figures) recorded high numbers of common pipistrelle bat passes (compared to other sites surveyed in London) throughout the night, with a maximum number of bat passes in one night at one location of 420 passes. The majority of these passes were between midnight and dawn suggesting that this activity was most likely to be associated with commuting bats along the tidal Thames.

6.4.11 Soprano pipistrelle, Nathusius' pipistrelle and noctule bat passes were recorded in low numbers, with each species only present on one survey night.

6.4.12 The buildings on and adjacent to the site are well maintained and the potential for bats to roost in these buildings is considered to be negligible. This is supported by remote recording survey results at location two and three where no bat passes were recorded. No activity was recorded at the site during dawn bat activity surveys, which suggests that a roost on or adjacent to the site is unlikely.

6.4.13 Common pipistrelle are likely to be commuting through the site along the tidal Thames or foraging around mature vegetation near to the site. Activity elsewhere on site is likely to be minimal as the foraging habitat here is considered to be poor. Records of soprano pipistrelle, nathusius' pipistrelle and noctule bat indicate that they pass through the site occasionally.

6.4.14 The common pipistrelle bat is the UK's most common bat species, and is a widespread species in Greater London although populations are in decline, mainly due to habitat loss (London Bat Group, 2012)[3]. Given the status of this species as an EPS and a priority species on the London BAP, and the fact that it is common relative to other UK bat species, the common pipistrelle population associated with the site is considered to be of low-medium (local) value.

6.4.15 Nathusius' pipistrelle, soprano pipistrelle and noctule bats are less common in London. These species are listed on the UK and London BAP. As very few passes of these bat species were recorded on the site, the populations of each of these bat species associated with the site are considered to be of low (site) value.

6.4.16 Leisler's bat (*Nyctalus leisleri)*, a priority species on the UK and London BAPs, has been recorded within 500m of the site according to desk study data. However, this species was not recorded in close proximity to the site during remote recording and dawn activity surveys. Therefore, Leisler's bats are not considered further in this assessment.

Wintering birds

6.4.17 During the Phase 1 Habitat Survey, the foreshore habitat along the tidal Thames was considered to have potential for wintering bird species and therefore, wintering bird surveys were undertaken. Details of the wintering bird survey are provided in Vol 14 Appendix D.1 and shown on Vol 14 Figure 6.4.4 (see separate volume of figures).

6.4.18 A total of 12 waterbird[iii] species were recorded on the foreshore on and adjacent to the site. Of these, six species are of nature conservation importance and are included on the Birds of Conservation Concern 3 (RSPB, 2009)[4] Red or Amber List[iv] and/or UK and London BAP as priority species (see Vol 14 Table 6.4.2).

[iii] A waterbird is a species which is listed in the Wetland Bird Survey (WeBS) methodology – British Trust for Ornithology, Royal Society for the Protection of Birds, Joint Nature Conservation Committee and Wildfowl and Wetlands Trust.

[iv] The conservation status of all regularly occurring British birds has been analysed in cooperation with the leading governmental and non-governmental conservation organisations, including the Royal Society for the Protection of

6.4.19 The six species of nature conservation importance are gadwall *(Anas strepera)*, mallard (*Anas platyrhynchos)*, black-headed gull (*Larus ridibundus)*, common gull (*Larus canus)*, lesser black-backed gull (*Larus fuscus)* and herring gull (*Larus argentatus*). Gadwall and mallard were recorded foraging on the muddy foreshore and along the water's edge as the tide receded. Four species of gull were recorded resting on the jetty and moored house boats to the west of the site.

6.4.20 The records of waterbirds of nature conservation importance recorded on the foreshore were compared to counts at other sites published in the *London Bird Report 2008* (London Natural History Society, 2011)[5]. The populations of all waterbird species on site are small relative to their populations in Greater London. The population of any one individual species of nature conservation importance is considered to be low-medium (local) value. The remaining six species of waterbird that are not of conservation importance are considered to each be of low (site) value.

Birds (RSPB), British Trust for Ornithology (BTO) and Birdlife International Birds of Conservation Concern 3 (RSPB, 2009). The basis of species ongoing population trends are assigned to one of three lists of Conservation Concern. These are the UK Red, Amber and Green lists. Although the lists confer no legal status in themselves, they are useful in evaluating the conservation significance of bird assemblages, and for assessing the potential significance of impacts and informing appropriate levels of mitigation with respect to bird populations.

Birds of Conservation Concern (BoCC) Red List criteria for breeding birds are those which have experienced a severe decline of more than 50% of population and / or range over the last 25 years, as measured by the number of 10km squares occupied by breeding birds of the species concerned. Species listed as globally threatened by Birdlife International and those with a historical decline in the UK between 1800 and 1995 (without evidence of recovery) are also included. BoCC Amber List criteria for breeding birds are those which have experienced a moderate decline of between 25% and 49% of population and / or range over the last 25 years. Species of European conservation concern and those with a historical decline but which are currently recovering are also included.

Vol 14 Table 6.4.2 Terrestrial ecology – wintering waterbirds of nature conservation importa*nce recorded within the* survey area

Common name	Latin name	Conservation designation[v]	Comments	Value
Gadwall	*Anas strepera*	Amber List	Gadwall was recorded on one occasion (January 2011) with a maximum count of four.	Low-medium (local)
Mallard	*Anas platyrhyncho s*	Amber List	Recorded each month, with a maximum count of seven both in February and March 2011 and numbers varying between one and six in other months.	Low-medium (local)
Black-headed gull	*Larus ridibundus*	Amber List	Recorded each month, with a maximum count of 83 in January 2011 and numbers varying between eight and 78 in other months.	Low-medium (local)
Common gull	*Larus canus*	Amber List	Recorded each month, with a maximum count of 14 in November 2011 and numbers varying between two and six in other months.	Low-medium (local)
Lesser black-backed gull	*Larus fuscus*	Amber List	Recorded each month between February and December 2011, with a maximum count of five in February 2011 and numbers varying between one and four in other months.	Low-medium (local)
Herring gull	*Larus argentatus*	Red List, UK and London BAP Priority List	Recorded each month, with a maximum count of 35 in October 2011 and numbers varying between two and 16 in other months.	Low-medium (local)

[v] A species that is listed in the following publications:

Batten, L.A., Bibby, C.J., Clement, P., Elliot, G.D. & Porter, R.F. (1990). *Red Data Birds in Britain*. T. & A.D. Poyser, London.

Commission of the European Communities (1979). Council Directive 79/409/EEC on the Conservation of Wild Birds. *Official Journal of European Communities, L103*.

Holliday, M & Rare Breeding Bird Panel (2011). Rare Breeding Birds in the United Kingdom in 2009. *British Birds*, 104, 9, 476-537.

Royal Society for the Protection Birds (2009). *Birds of Conservation Concern 3*. RSPB, Sandy.

United Kingdom Biodiversity Action Plan Steering Group (2011). *United Kingdom Biodiversity Action Plan* http://jncc.defra.gov.uk/page-5163 [10.11].

Black redstart

6.4.21 The Phase 1 Habitat Survey identified that the buildings on site are considered to have potential to support nesting black redstart. As black redstart is known to regularly nest on Battersea Power Station (Battersea Power Station, 2009)[6], 140m to the west of the site, it is considered likely that black redstart occasionally visit the site. Therefore, surveys were undertaken to determine whether black redstart are nesting on site. Full results are given in Vol 14 Appendix D.1 and shown on Vol 14 Figure 6.4.5 (see separate volume of figures).

6.4.22 The Rare Breeding Birds Panel for the UK reported that 20–54 pairs of black redstart were identified at 49 sites in 2008, with birds reported from 21 counties nationally (Holling and Rare Breeding Birds Panel, 2008)[7]. The population in London therefore represents between 10% and 30% of the UK population (RSPB, 2012)[8].

6.4.23 No black redstarts were recorded on site during surveys and it is considered unlikely that they are currently using the site for nesting. Therefore, the value of the black redstart resource is considered to be negligible. While there are many opportunities for black redstart to nest and forage in London, not all these locations are occupied by this species. This is mainly due to the rarity of black redstart in the UK and in London. Therefore, black redstarts are not considered further in this assessment.

Invasive plants

6.4.24 A survey for invasive plant species was undertaken at the Kirtling Street site as potential for their presence was identified. No invasive plant species listed in Schedule 9 Part II of the Wildlife and Countryside Act 1981 (as amended) were recorded within or in the immediate vicinity of the proposed development site (Vol 14 Figure 6.4.6).

Noise, vibration and lighting

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

6.4.26 Current sources of noise and vibration (see Section 9 of this volume) are associated with the operation of the CEMEX plant on site and vehicle movement from adjacent roads to the south and east of the site, which include Cringle Street, Kirtling Street and Nine Elms Lane.

6.4.27 At night, the area receives relatively high levels of light spill from river traffic, street lighting and riverside developments. The CEMEX plant is currently lit by security lighting. Street lights also line the adjacent Kirtling Street.

Construction base case

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

6.4.29 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. The levels of vibration around the site are considered unlikely to change between the present time and the base case.

6.5 Construction effects assessment

Construction impacts

Habitat clearance and creation

6.5.1 Habitats and buildings on site, which are all of negligible value, would be removed as part of construction works.

6.5.2 There would be temporary loss of an area of foreshore during construction at both the Kirtling Street and Heathwall Pumping Station site, as this area would be occupied by temporary structures and jetty facility respectively The foreshore would be reinstated following completion of works. A small area of foreshore would be permanently lost to the structure proposed within the foreshore at the Heathwall Pumping Station site. The foreshore is currently used by wintering birds for foraging and resting.

Movement, noise, vibration and lighting

6.5.3 An increased level of activity is anticipated on site in the locations of the current warehouse buildings, as current activity is limited to the occasional movement of people and vehicles to and from warehouse buildings.

6.5.4 Noise and vibration impacts are based upon the data and assessment in Section 9 of this volume. Noise levels are predicted to be higher than the ambient noise levels throughout the construction. There may be occasional sudden noises on site created by the movement of materials or the starting of vehicles. Vibration levels are likely to increase during construction.

6.5.5 Construction would require there to be some lighting in the early morning and evening during the winter months to facilitate the extension of standard working hours. There would also be periods where lighting is required to facilitate 24 hour working. Given the high background light levels at this location and with measures as detailed in the *CoCP* Part A (Section 4) implemented at this site, light spill from construction lighting would be minimal. Therefore, disturbance from construction lighting is unlikely to disturb wintering birds and bats.

6.5.6 As no bat roosts have been identified, bats are only likely to be present within habitat adjacent to the site whilst foraging and commuting at night. Foraging and commuting bats are unlikely to be affected by the increases in noise and vibration levels, and movements of vehicles at night.

Barging

6.5.7 Existing background light levels associated with navigational lighting close to the Kirtling Street and Heathwall Pumping station site are considered likely to be high. With measures in the *CoCP* Part A (Section 4), additional increases in lighting levels associated with the Kirtling Street and Heathwall Pumping station construction works is likely to be minimal, although some disturbance from lighting is anticipated on wintering birds and commuting bats.

6.5.8 Disturbance from the movement of barges in and out of the site, and wash on the foreshore, is likely to cause disturbance to wintering birds on the foreshore adjacent to the site.

Construction effects

Habitats

6.5.9 The loss of a small area of ephemeral/short perennial habitat, introduced shrub, buildings and hardstanding, all considered to be of negligible value would have no significant effect on terrestrial ecology. Therefore, the effects on all habitats on site are considered to be probable, **negligible** and not significant.

Species

Bats

6.5.10 There would be temporary loss of a small area of foreshore habitat for bats at both the Kirtling Street and Heathwall Pumping Stations sites, which is likely to result in displacement of bats to adjacent habitat along the tidal Thames foreshore. The displacement is not considered likely to affect the local bat populations. The effect is therefore probable, **negligible** and not significant.

6.5.11 As there are currently no roosts on or adjacent to the site, there would be no disturbance to roosting bats. The presence of the barge facilities and small changes in light levels as a result of navigational lighting are unlikely to create a barrier to the movement of commuting bats given the existing high background light levels. Common and soprano pipistrelle bats can tolerate relatively high light levels, up to 14 lux. Noctule bats tend to fly high, only occasionally moving closer to the ground to forage. Noctule bats are therefore considered unlikely to be affected by light spill at the level of the river. There may be slight changes in bat behaviour as bats would need to commute over or around the barge facilities. The tidal Thames is a wide corridor and the function of this habitat is likely to be maintained. It is considered unlikely that changes in light levels and changes in commuting behaviour would have an effect on the local distribution and abundance of bat populations. Therefore, the effect is considered to be probable, **negligible** and not significant**.**

Wintering birds

6.5.12 Works within the foreshore would result in the loss of foreshore habitat for wintering waterbirds during construction at both the Kirtling Street and Heathwall Pumping station sites. It is considered likely that the small number of waterbirds that use the site for foraging and resting would be displaced to other areas of foreshore adjacent to the site and in the wider area. Following reinstatement of the foreshore, wintering birds are likely to return to the site. No perceptible change in wintering bird populations associated with the site are anticipated. Therefore, the effect on wintering bird populations of habitat loss at the site is considered to be probable, **negligible** and not significant.

6.5.13 There would be a small temporary increase in noise and vibration levels. It is considered unlikely that waterbirds from the tidal Thames adjacent to the site would be displaced. Occasional displacement of birds is expected where sudden noises occur and when barges pass close by, with small numbers of wintering birds from adjacent intertidal habitat temporarily moving away from the habitat and returning shortly after. This displacement and return of wintering birds has been observed on the foreshore at other sites on the Thames Tideway, particularly where people walk along the foreshore. It is considered unlikely that this displacement would result in a perceptible change in wintering bird populations. Therefore, the effect of disturbance on wintering bird populations is considered to be probable, **negligible** and not significant.

Sensitivity test for programme delay

6.5.14 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 - 6.5.13). While phases of other developments may shift from cumulative to base case, it is not considered that this would change the assumptions about terrestrial ecology conditions and therefore the base case would remain as described in paras. 6.4.28 - 6.4.29.

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 No likely significant cumulative effects on terrestrial ecology have been identified as a result of construction activities from those developments identified in para. 6.3.11. Therefore, the effects on terrestrial ecology would remain as described in Section 6.5.

Sensitivity test for programme delay

6.7.2 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, the cumulative effects assessment would remain unchanged. Para. 6.7.1 describes the cumulative effects on terrestrial ecology, which would remain unchanged with a programme delay of approximately one year.

6.8 Mitigation

6.8.1 All measures embedded in the design and the *CoCP* Part A (Section 11) of relevance to terrestrial ecology are summarised in Section 6.2. As no significant adverse effects were identified in Section 6.5 at this site, no further mitigation measures are required.

6.9 Residual effects assessment

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

6.10 Assessment summary

Vol 14 Table 6.10.1 Terrestrial ecology – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Habitats				
Buildings, hardstanding, ephemeral/short perennial and introduced shrub	No significant change in habitat on site as the habitats to be removed are considered to be of negligible value.	Negligible	None	Negligible
Notable species				
Bats	No change in bat populations as a result of temporary loss of foraging and commuting habitat for bats.	Negligible	None	Negligible
	No significant changes to bat populations as a result of disturbance from small increases in light levels and works within the foreshore.	Negligible	None	Negligible
Wintering birds	No significant changes in populations of wintering birds due to temporary loss of foreshore habitat for foraging and resting habitat on site.	Negligible	None	Negligible
	No significant changes in wintering bird populations as a result of disturbance from noise, vibration and the movement of barges.	Negligible	None	Negligible

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Thames Tideway Tunnel
Thames Water Utilities Limited

Thames Water

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 7: Historic environment

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling Street site assessment

Section 7: Historic environment

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7 Historic environment

7.1 Introduction

7.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on the historic environment at the Kirtling Street site. The historic environment is defined in para. 4.10.2 of the NPS as including all aspects of the environment resulting from the 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 An assessment of effects from ground movement resulting from the Thames Tideway Tunnel itself is covered in Volume 3 Project-wide Effects. No effects are predicted on historic receptors in the vicinity of this site, therefore no assessment of ground movement effects is presented.

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

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

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

7.1.7 The assessment of the historic environment effects of the project has considered the requirements of the National Policy Statement for Waste Water (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.

7.1.8 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling 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 could potentially truncate or entirely remove any archaeological assets within the footprint of the works.

7.2.3 The construction of the works compound would be likely to entail preliminary site stripping, assumed for the purposes of this assessment to reach a depth of approximately 0.5 m below ground level (mbgl). Site fencing would be erected, supported by timber posts in concrete foundations. Office, storage and welfare facilities would be constructed on pad foundations with a depth of approximately 1.0mbgl. Site setup would also entail the construction of new service trenches up to approximately 1.5m deep to allow utility connections to the buildings in the works compound (see Construction phase 1 plan, separate volume of figures - Section 1).

7.2.4 The initial set-up of the site for construction works would require the demolition of 19th and 20th century buildings, comprising the former Cable and Wireless buildings and office buildings along Brooks Court on the south side of Cringle Street; the former Securicor Depot and the two brick-built depot and warehouse buildings on the north side of Cringle Street; and the former V & A stores and the brick and steel warehouse building on the north side of Kirtling Street (see Demolition and site clearance plan, separate volume of figures – Section 1). The temporary offices, concrete batching plant and storage bins within the CEMEX site in the western part of the site would be relocated to the southern part of the CEMEX site (see Construction phase 1 plan, separate volume of figures - Section 1).

7.2.5 A river jetty would be constructed on the Thames foreshore and riverbed to allow barge access to the site. This would be constructed of tubular steel piles, which would be driven from a jack-up barge in the Thames. Following completion of piling, the deck of the jetty would be constructed. This structure would be built further into the river than the existing CEMEX Kirtling Wharf (also known as Cringle Wharf) jetty and would be connected to the shore by a supporting structure for overhead conveyors, assumed for the purposes of this assessment to have been piled in the same way as the main jetty structure (see Construction phase 1 plan, separate volume of figures - Section 1). To facilitate access for barges, an area of approximately 100m x 25m within the north-western half of the existing Kirtling Street jetty would be dredged to a depth of approximately 1m, as assumed for the purposes of this assessment.

7.2.6 Permanent works which would affect buried assets include the deep shaft excavation for a main tunnel double drive shaft, and a combined ventilation chamber, air treatment chamber and electrical and control kiosk to be built on the landward, southern, side of the existing riverside wall (see Site works parameter plan, separate volume of figures - Section 1).

7.2.7 CEMEX buildings and concrete batching plant would be rebuilt in the southern part of the site. The components of this work would include the reconstruction of heavy water tanks and silos, aggregate storage bins and a below-ground aggregate transfer conveyor, all with deep piled foundations. The smaller footprint for the CEMEX works would mean that the reconstructed silos would be approximately 30m high. There would also be further water tanks and stone washing and drying facilities with shallower foundations. It is assumed for the purposes of this assessment that these foundations would entail ground disturbance to a depth of approximately 2-3m.

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

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

b. use of cranes and other plant during shaft construction sinking, including the noise enclosure over the shaft and gantry crane (‘noise shed’) and secondary lining of the main tunnel

c. provision of welfare facilities

d. lighting of the site when required.

Code of Construction Practice

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

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

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

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

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

d. Care would be taken when jack-up barges, piling or borehole rigs, mechanical excavators or other plant is operating over areas of the river channel or foreshore known to be particularly archaeologically sensitive. In exceptional cases exclusion zones may apply. Safeguards may include appropriate methods for installing and operating plant, and the use of suitable foreshore protection.

e. 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.

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

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

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

7.2.12 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 a *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. 7.8.6.

Operation

7.2.13 The operation of the proposed development at the Kirtling 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.

7.2.14 The operational design has been developed through close liaison with stakeholders 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 proposed development, including design iterations, are fully detailed in Section 3 of this volume.

Historic environment design measures

7.2.15 A 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. Principles for the integration of functional components relevant to this site including those relating to the efficient use of land, and to high quality design because they would inform the appearance of the completed operational infrastructure.

b. All the landscape principles relating to trees, safety and security, the quality of soft and hard landscaping, materials and public accessibility that are relevant to the site.

c. All the lighting design principles regarding heritage and sensitive settings that are relevant to the site. These include matters relating to safety, avoiding light pollution and the quality of fittings.

7.2.16 The following site-specific design principles are relevant at this site:

a. No landscape works would be undertaken except for new tree planting on Kirtling and Cringle Streets (subject to the agreement of the highway authority) and interim provision of signage for the Thames Path.

The electrical and control kiosk and ventilation column would be combined in a single structure (as shown in the Kiosk and ventilation column design intent drawing, see separate volume of figures - Section 1). The project's signature ventilation column would not be used.

b. The materials and design of any reinstatement works outside of Kirtling Wharf would be consistent with the Riverlight development in order to support a coherent public realm in the area.

c. At the end of construction, the project would secure those parts of the site that are not public highway or concrete batching plant with high quality secure hoardings.

7.3 Assessment methodology

Engagement

7.3.1 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 the historic environment are presented here. Throughout the environmental impact assessment (EIA) there has been regular liaison with English Heritage and other stakeholders. Vol 14 Table 7.3.1 below summarises the comments raised by consultees and how each comment has been addressed.

Vol 14 Table 7.3.1 Historic environment – consultation response

Organisation and date	Comment	Response
English Heritage phase two consultation response (February 2012)	Concern expressed about potential impact of main shaft on earlier river and dock walls.	The *Environmental Statement* assesses the impact of the shaft on earlier river walls and dock walls (see Section 7.5).

Baseline

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

7.3.3 Baseline conditions for above-ground and buried assets are described within a 600m radius area around the centre point of the site, which is considered through professional judgement to be most appropriate to characterise the heritage potential of the site. There are occasional references to assets beyond the baseline area, for example, the Old Battersea Bridge which lies approximately 610m to the west of the site, which contribute to current understanding of the site and its industrial environs in the post-medieval period.

7.3.4 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 600m baseline area. In addition, ‘Views of Heritage Value’ (VHV) considered important for understanding the historic character and setting of heritage assets have been identified where appropriate. These are drawn from the Churchill Gardens and Dolphin Square conservation area audits and from professional judgement based on observation and understanding of historic context and architectural purpose and design.

7.3.5 A site survey was carried out in the summer of 2011, when low tide was at 98.0m ATD (Above Tunnel Datum; the equivalent of 2.0m below Ordnance Datum) and the foreshore was accessed from 88 Kirtling Street. A further site visit was carried out in January 2012 to identify assets for inclusion within the assessment of effects on setting.

Construction

7.3.6 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.

7.3.7 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.

7.3.8 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 in Site Years 3-5, during the main tunnel drive and subsequent secondary lining, including 24 hour working and the presence of the noise shed at the site (see Construction phase 1 plan, separate volume of figures - Section 1). This has therefore been used as the assessment phase for effects on the character and setting of heritage assets. It should be noted that in some instances, the townscape and visual assessments may differ to the historic environment assessments 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 explained in relation to each asset as appropriate). The construction assessment area is as described in para. 7.3.4.

7.3.9 Section 7.5 details the likely significant effects arising from construction. The Kirtling Street site lies close to the western edge of the Thames Tideway Tunnel Heathwall Pumping Station site. The double drive shaft of the Kirtling Street site would be c 350m to the west of the CSO drop shaft of the Heathwall Pumping Station site. The Heathwall Pumping Station site is therefore considered in this assessment in terms of effects on buried assets for its potential to give rise to additional effects on the historic environment, given that it is situated in the same topographical and geological environment for the prehistoric and historical periods and would have shared a similar post-medieval industrial history.

7.3.10 In terms of effects on the character and setting of above ground heritage assets, similarly the construction assessment area for this site intersects with the assessment areas for the proposed Thames Tideway Tunnel site at Heathwall Pumping Station. The effects of Heathwall Pumping Station together with the Kirtling Street site are assessed in this volume.

7.3.11 In terms of the 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. At this site ongoing fluvial erosion is changing the archaeological baseline within the foreshore. However, the rate of erosion is not known so the base case is assumed to be as per the baseline. Furthermore none of the schemes in the site development schedule (Vol 14 Appendix N) would lead to physical changes in above-ground or buried heritage assets within the 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, and is not detailed further within the construction base case. Therefore any changes to the surrounding baseline would not affect the assessment and are not detailed further within the construction base case.

7.3.12 The following developments from the site development schedule (Vol 14 Appendix N) have been considered as part of the construction base case for the assessment of effects on historic character, appearance and setting in the construction phase due to their proximity to the site:

a. Riverlight Tideway Industrial Estate, adjacent to the site

b. Battersea Power Station, 50m to the west of the site (Phases 1, 2 & 3).

7.3.13 None of the schemes included in the site development schedule (Vol 14 Appendix N) are relevant for inclusion in a cumulative assessment of physical effects on heritage assets within the site during construction. This is because there are no known assets common to the Kirtling Street site and those schemes listed in the site development schedule. It is possible that a currently unknown buried heritage asset may extend from a neighbouring site to the Kirtling Street site, but such remains are likely to be only of low asset significance, for example, drainage ditches or flood embankments. Therefore no assessment of cumulative effects has been undertaken for physical effects on buried heritage assets in the construction phase.

7.3.14 As detailed in the site development schedule (Vol 14 Appendix N) the schemes which lie within 1km of the site which meet the criteria for inclusion in the cumulative assessment in relation to above-ground assets for the peak phase of construction are as follows:

a. Battersea Power Station

b. Embassy Gardens, Land South of Nine Elms lane

c. New Covent Garden Market (Entrance Site).

7.3.15 Therefore these schemes have been assessed cumulatively, alongside construction of the Thames Tideway Tunnel project at Kirtling Street. Other nearby schemes have not been assessed as they affect no known assets common to the site and are separated from it by intervening buildings.

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 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 this site 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 assessments may differ to the historic environment assessments of the operational phase, 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 explained in relation to each asset as appropriate). The operational assessment area is as described in para. 7.3.4 above, with the exception that although Churchill Gardens and Dolphin Square conservation areas would be affected by the construction phase proposals, the operation phase elements would form a negligible part of their settings and there would therefore be no effects. These conservation areas are therefore not assessed in the operational assessment.

7.3.18 The operational assessment area for this site intersects with the assessment areas for the proposed Thames Tideway Tunnel site at Heathwall Pumping Station in addition, the following schemes from the site development schedule (Vol 14 Appendix N) have been considered as part of the operation phase base case for the assessment of effects on historic character, appearance and setting due their proximity to the site:

a. Riverlight Tideway Industrial Estate, adjacent to the site

b. Battersea Power Station, 50m to the west of the site (all phases)

c. New Covent Garden Market, 150m south east of the site (Entrance Site only)

d. Nine Elms Parkside (Plots A, B, C and D).

7.3.19 None of the schemes included in the site development schedule (Vol 14 Appendix N) including the nearby development at Nine Elms Parkside (Plots E, F and G) identified as being under construction during the operational phase of the project at Kirtling Street would have a significant cumulative effect on the historic character and setting of the above-ground heritage assets such as Battersea Power Station in the operational phase, because of the distance of these schemes from the site and the presence of intervening structures. Therefore no assessment of cumulative effects in the operational phase has been undertaken.

7.3.20 The assessment of operational effects on the character, setting and appearance 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

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

Assumptions

7.3.22 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 Site works parameter plan (see separate volume of figures – Section 1) 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 heritage assets of high significance on the landward side of the river wall, which would warrant preservation *in situ* (see Site works parameter plan, separate volume of figures - Section 1).

7.3.23 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.

7.3.24 It is proposed to build a jetty in the river channel to facilitate the transportation of materials to and from site by barge. It is assumed that all elements of this structure within the river would be supported on piled foundations and that this structure would have some effect on the fluvial regime for the duration of the construction works after which it would be removed (see Construction phase 1 plan, separate volume of figures - Section 1).

7.3.25 The assessment of effects on above-ground assets is similarly based on the above-ground structures being located anywhere within the zones for these structures. For this site the assessment is not sensitive to variations in location within these zones because of the predominantly open character of the surrounding townscape, or the presence of structures which are of negligible value or which would be removed by the proposed development.

Limitations

7.3.26 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 in the baseline area around the site. The assessment is therefore 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 six sub-sections:

a. a description of historic environment features within the 600m 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 above-ground and buried heritage 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 14 Figure 7.4.1, see separate volume of figures) shows the location of known above-ground and buried historic environment features within the 600m-radius baseline area, compiled from the baseline sources set out in the methodology in Vol 2. These have been allocated unique historic environment assessment reference numbers (eg, HEA 1, 2, etc), which are listed in the gazetteer in Vol 14 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 the 'Statement of significance: above-ground heritage assets' below in paras. 7.4.38 - 7.4.48.

Designated assets

International and national designations

7.4.3 The site and its immediate vicinity do not contain any nationally designated (statutorily protected) heritage assets, such as scheduled monuments, listed buildings, or registered parks and gardens. Nor does it contain any internationally designated heritage assets. The significance of assets is described further in 'Statement of Significance; above ground heritage assets' below in paras. 7.4.38 - 7.4.48.

7.4.4 The closest buildings to the site which are statutorily listed are the Grade II* listed Battersea Power Station (HEA 16), approximately 160m to the west, and the Grade II listed mid-19th century Battersea water pumping station (HEA 17) on Cringle Street, approximately 100m to the west.

Local authority designations

7.4.5 Most of the site is located within an Archaeological Priority Area, as defined by Wandsworth Council in recognition of the archaeological potential of the Thames floodplain. The site does not lie within or adjacent to a conservation area and contains no locally listed buildings.

Known burial grounds

7.4.6 There are no known burial grounds within the Kirtling Street site. A former burial ground belonging to the now demolished 19th century Church of St. George the Martyr (HEA 6) is located across Battersea Park Road, approximately 40m to the southeast of the site. The graveyard was clearly separated from the site by the present Battersea Park Road (formerly Nine Elms Lane) and, according to historic maps dated from 1862 onwards (about 35 years after the construction of the church) the graveyard has never extended into the area of the site.

Site location, topography and geology

7.4.7 The northern part of the site lies within the channel of the River Thames and on its southern foreshore. The central part of the site, lying on the river bank, is currently used to house a number of works and warehouse buildings to the north of Cringle Street, whilst the southern part of the site contains depot buildings, yards, and offices, shops and residential properties.

7.4.8 The ground along the south bank of the Thames slopes gently downwards from north to south, from approximately 105.0–105.2m ATD at the northern end of Kirtling Street in the centre of the site, down to approximately 104.2–104.4m ATD at the junction with Cringle Street. There is a slight depression in ground level at the southern end of the site, where the ground lies at approximately 103.9m ATD. The northern part of the site, situated on the Thames foreshore and within the southern part of its main channel, lies at approximately 101.0m ATD near the riverside wall, dropping down to approximately 98.0m ATD at the level of low tide. Further north into the Thames, the riverbed falls to just above 95.0m ATD at the northwestern edge of the site beside Kirtling Wharf jetty and has been dredged more deeply, to around 94.0m ATD, in the northeast to the north of Nine Elms Pier.

7.4.9 Most of the site is located geologically over alluvium. A gravel river terrace is located within the southwestern end of the site and underlies approximately 10% of the total site area. This remnant river terrace is one of two outcrops of Kempton Park Gravels that lie within the floodplain of the Thames in this area. The river terrace and the Thames together formed the ‘Battersea Eyot’ on which Battersea Park is located. The Battersea Eyot was formerly dissected by channels of the Thames. Most of the site is located between the confluence of two of these former channels and the Thames.

7.4.10 The alluvium and the river terrace represent distinctly different geological areas. The alluvium, on which the majority of the site lies, is potentially 3.0–4.0m thick. During the Mesolithic and early Neolithic periods, climate change, human activity and rising sea levels led to the expansion of wetlands, which provided the conditions for the formation of deep areas of alluvium and peat deposits with high potential for palaeoenvironmental preservation.

7.4.11 British Geological Survey digital data notes a strip of made ground in the northern half of the site to the south of the river wall. This probably relates to the infill of two 19th century docks at this location. There are no reliable borehole records from within the overland portion of the site but information is available from a group of boreholes to the east of the site over alluvium in a similar topographic area, where alluvium lay at 101.1m ATD and 102.4m ATD under approximately 4.9m of made ground. The alluvium is described as organic silty clay with pockets of fibrous organic material (peat). In one borehole no alluvium was recorded as it had probably been truncated by localised dredging. Gravels of the floodplain area lay under the alluvium with levels of between 99.1m ATD and 100.4m ATD at the surface. Boreholes drilled within the Battersea Channel to the south of the site found the gravel surface at 97m ATD. A vibro core (VC6032) recorded peat from 97.0m ATD and alluvial clays from 98.6m ATD. The thickness of the peat is not known, but at least 1.6m of alluvial deposits exist and are overlain by 0.4m of foreshore gravels. This would imply that archaeological deposits survive below the foreshore from approximately 98.6m ATD; however, no archaeological deposits are thought to survive within the areas to the north of the Kirtling Wharf jetty and the Nine Elms Pier where dredging would have removed deposits to below 96.0m ATD. The site topography and geology is discussed in more detail in Vol 14 Appendix E.2.

Past archaeological investigations

7.4.12 No past archaeological investigations have been carried out within the site itself. A foreshore survey to the east of the site uncovered post-medieval remains, including flood defences, barge beds, former dock entrances, foreshore consolidation deposits and a fish trap of Saxon date (HEA 55), c 150m to the northeast. Other investigations carried out within the baseline area revealed evidence of post-medieval activity including a water works, a brewery and 16th–17th century domestic features. Further details of past archaeological investigations carried out within the site and baseline area are included in Vol 14 Appendix E.3.

Archaeological and historical background of the site

7.4.13 The following section presents a chronological summary of the archaeological and historical background of the site. Further detail is included in Vol 14 Appendix E.4.

7.4.14 The site would have remained largely dry during the prehistoric period (c 700,000 BC–AD 43), although during the later prehistoric period it would have become increasingly wet and marshy and subject to periodic flooding. The confluence of the river channels could have provided rich natural resources and the high ground of the terrace could have been a suitable point for settlement or occupation. A Neolithic axe and a flint pick (HEA 1E) were recovered as single finds from the Thames channel within the northern boundary of the site. There are no other known remains dating to the prehistoric period within the site. In the baseline area, two Mesolithic axes (HEA 12 and HEA 13) were recovered from the Thames channel. Two maceheads (HEA 11), one dating to the Mesolithic and the other to the Neolithic period, were discovered at Battersea Power Station and a socketed spearhead (HEA 10) dating to the late Bronze Age was discovered c 360m to the west of the site. From the later prehistoric period relative sea level rose and the River Thames became wider and the floodplain wetter. Alluvial deposits of that date might provide the type of environment in which remains of boats or fish traps might survive, as well as palaeoenvironmental evidence.

7.4.15 The only known remains dating to the Roman period (AD 43–410) from the vicinity of the site are three coins recovered from the river (HEA 62 and HEA 63). During this period the southern part of the site would have lain on dry land suitable for settlement, whilst the rest of it would have been marshy, prone to flooding, and unlikely to have been inhabited. The general lack of finds within the baseline area suggests that it was not a focus for Roman settlement.

7.4.16 During the early medieval period (AD 410–1066), as in earlier periods, the southern part of the site would have lain on a higher and drier gravel terrace, whilst the northern part would have been more low-lying and liable to flooding. A recent survey identified a series of twenty-eight stakes in parallel lines on the foreshore, which are interpreted as the remains of a fish trap (HEA 55), 150m to the east of the site. Three of these timbers were radiocarbon-dated to the late 6th to early 7th centuries AD, giving them a very firm date in the (Early) Saxon period. The closest known settlements to the site of Saxon date were centred on Vauxhall, approximately 1.3km to the northeast, and Battersea Village, centred on St. Mary’s Church, approximately 2.5km to the southwest. The site therefore lay outside the likely areas of occupation in this period and was probably marshy land that could have been used for pasture.

7.4.17 The only known finds dated to the later medieval period (AD 1066–1485) within the baseline area comprise a coin (HEA 58) and coin weight (HEA 63) recovered from the river. The marshes probably began to be reclaimed in stages during this period, with fertile land being used for pasture and cultivation. The site probably continued to lie in open, undeveloped land between the medieval parishes of Battersea and Vauxhall. The site of a building called Manor House and Manor House Wharf (HEA 8) is marked 180m to the east of the site on the Ordnance Survey 1st edition map of 1874 (Vol 14 Appendix E.5, Plate E.4) and subsequent maps, although no derivation is known for the name and there is no corroborative evidence that it is of medieval origin. No manor is recorded in the area in the Domesday Book (AD 1086).

7.4.18 In the 16th and 17th centuries the area of the site would have been in a well-known area of cultivation, approximately 2.5km to the northeast of the main settlement of Battersea. The site of a 17th century mill (HEA 1A) is thought to lie within the northern part of the site. In the mid 18th century the site lay within the northeast corner of Battersea Common Field, a large area of drained and reclaimed open land.

7.4.19 During the early 19th century timber docks with associated river walls were built in the north of the site and these were gradually filled in as the century progressed. Battersea New Town began to be constructed in the 1790s for housing for an expanding labour force. Development continued in the early 19th century along the waterfront, while the rest of the site remained as open ground. The Southwark and Vauxhall Water Works

(HEA 9) were built in 1839 to the west of the site. The site remained a predominantly industrial area throughout the 19th century.

7.4.20 Foreshore surveys to the east of the site have identified post-medieval features including two dock entrances (HEA 42 and HEA 47), two post-medieval riverfront defences (HEA 44) and consolidation layers and possible barge beds (HEA 50 and HEA 54).

7.4.21 The northeastern part of the site contained industrial buildings by the late 18th century. The southern part of the site was an empty plot of land, although bounded by a new road to the west, which is now known as Kirtling Street. During the Second World War some of the buildings on the site sustained damage, and some were rebuilt or repaired afterwards. A new wharf, car park, garage and transport depot was subsequently constructed on the site.

7.4.22 The northern part of the site lies on the southern foreshore of the Thames, and partially within the Thames channel. A jetty for the compound works (HEA1G) stands on the foreshore in the northwestern part of the site. A pontoon (HEA 1C) is located within the northern part of the site on the foreshore. This is the location for the western navigation light of Nine Elms Pier which lies just outside of the site to the east (HEA 66). The western part of the site is occupied by hard-standing and industrial buildings. The eastern part of the site has a large modern warehouse building on it and the central part of the site is occupied by offices and warehouses. A mixture of buildings and open space, including a vehicle depot, a vacant former filling station, warehouses and offices, covers the southern part of the site.

Statement of significance: buried heritage assets

Introduction

7.4.23 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, for example, building foundations), identified from historic maps, the site walkover survey, and information on the likely depth of deposits.

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

Factors affecting survival

7.4.25 Archaeological survival potential across the site is likely to be variable. Around a third of the site is on the foreshore area. The excavation of docks in the early 19th century within the remaining landward part of the site would have locally removed earlier archaeological remains from within their footprints. Here deeply buried prehistoric and palaeoenvironmental remains might still survive intact beneath the made ground, depending on the depth of the dock excavations.

7.4.26 Historic maps from the mid-19th century show a number of buildings on the northern part of the site. These are unlikely to have had basements or piled foundations, and were probably constructed on pad or strip footings to a depth of 1.0–1.5m, which will have extended into made ground used to consolidate the land behind the river wall in the 18th century (or earlier).

7.4.27 The foundations of the latest warehouses on the landward side of the river wall are likely to comprise strip footings with a depth of 0.5–1.0m, or piled foundations along the structural walls. Piled foundations would have removed any remains within their footprints. The impact would depend on pile size and density, which are not currently known. Considering the likely depth of the made ground, strip or pad footings would probably have truncated only remains of post-medieval date. Earlier deeper remains are likely to be preserved intact.

7.4.28 The existing buildings in the southern part of the site, south of Cringle Street, including a light industrial works, depot, former filling station and shops and an earlier 20th century engineering works and public baths may have had piled foundations or strip foundations, with a similar localised impact as discussed above. The construction of the swimming baths shown on the Ordnance Survey 3rd edition map of 1916 (Vol 14 Appendix E.5 Plate E.6) in the eastern part of the site south of Cringle Street will have had a greater impact on the underlying layers depending on the size and depth of the pool.

7.4.29 The southwestern half of this part of the site lies on the higher gravel terrace so that any archaeological remains are likely to have extended to a lesser depth. Modern building foundations and any existing utilities trenches are likely to have truncated or removed a greater proportion of the upper levels of any archaeological remains here.

7.4.30 Dredging has taken place within the main River Thames channel, as evidenced by Thames Tideway Tunnel project bathymetry survey data. This shows that along the northern edges of the Kirtling Wharf jetty and the Nine Elms Pier that the riverbed has been dredged to depths of between 94.0 and 96.0m ATD. Between the existing mooring stations the river bed has apparently not been dredged to the same depth and it survives to approximately 98.0m ATD.

Asset potential and significance

7.4.31 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

7.4.32 The site has a high potential to contain palaeoenvironmental remains. The majority of the site, excluding the southwestern part, is located on the alluvial floodplain of the River Thames and at the northwestern edge of a confluence of the channels through the Battersea Eyot and the Thames. The part of the site which has not been truncated by the late 18th century dock excavation has a high potential to preserve palaeoenvironmental remains in good condition within deep alluvial sediments. Such remains would potentially be of low or medium significance depending on their nature and condition. This is derived from the evidential value of such remains. The southwestern part of the site, lying on higher ground inland, has a low potential for the recovery of palaeoenvironmental remains.

Prehistoric

7.4.33 The site has a moderate potential to contain earlier prehistoric, particularly Mesolithic to Bronze Age prehistoric remains. The site would have remained largely dry and the confluence of the Thames and the Battersea Channels, both of which would have been fresh water in this period, would have provided a useful range of resources for prehistoric people. Waterlogged conditions potentially provide suitable conditions for the preservation of organic prehistoric remains such as timber trackways, revetments or boats. The drier gravel terrace would have been more suitable for settlement and agriculture. Redeposited finds would be of low significance. Localised settlement evidence would be of medium significance. The remains of timber structures, trackways or boats could be of high significance depending on their condition and proof of date. The significance of such remains would be derived from their evidential value.

Roman

7.4.34 The potential of the site to contain Roman remains is considered to be low. It lay within the Thames floodplain and would have been prone to flooding. The paucity of known remains within the site and its vicinity suggests that it was not settled. Isolated artefacts and features would be of low significance which would be derived from the evidential value of such remains.

Early medieval

7.4.35 The site has a moderate potential to contain early medieval remains. The site lay within the Thames floodplain and was liable to frequent flooding throughout this period and is thus unlikely to have been an area of settlement. There is potential for further remains of Anglo-Saxon period wooden fish traps, like the one noted on the site visit walkover survey (HEA 55), c 150m to the northeast of the site. Nine possible examples are known in the central London area, seven of which are firmly dated to the Saxon period. Saxon fish traps would be of medium to high significance, depending on their state of preservation and conclusive proof of their date, and this would be derived from the evidential and historical value of such remains.

Later medieval

7.4.36 The site has a low potential to contain later medieval remains. Towards the end of this period the marshland probably began to be reclaimed to be used as agricultural land. It is possible that reclamation river walls and drainage channels may survive and the waterlogged conditions of the majority of the site would have the potential to preserve timber structures, although past impacts from the construction of the 19th century docks and 20th century sewage tunnels will have removed such remains locally.

Remains of reclamation and flood defence would be of low significance, which would be derived from their evidential and historical value.

Post-medieval

7.4.37 The site has a high potential to contain post-medieval remains. The site and its immediate surroundings developed into an area of concentrated industrial activity from the 18th century onwards. Within the area of the site, remains of two 19th century timber docks, with associated river walls and later industrial structures, including a 19th century lead works and an early 20th century engineering works may survive. Such remains would be of low significance.

Statement of significance: above-ground heritage assets

Introduction

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

7.4.39 It also describes the significance, historic character and setting of conservation areas and settings of listed buildings within the construction and operational Zones of Theoretical Visibility (ZTV) where their historic character, appearance and settings may be affected by the proposed development. Such assets are shown in Vol 14 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, which form a part of their setting. There are no other heritage assets in the assessment area whose settings would be significantly adversely affected by the proposed development.

Within the site

7.4.40 Within the eastern part of the centre of the site is a group of brick buildings which date from the late 19th to early 20th centuries (Vol 14 Appendix E.5, Plate E.9). The buildings occupy the entire block bounded by Cringle Street to the south, and Kirtling Street to the west, north and east. Perhaps the earliest of these buildings is the one which occupies the northeast corner of the block, whilst the southeast corner of the block is occupied by a larger, later building, with an impressively large doorway, now blocked, which opened south on to Cringle Street. Above the door is a panel with the name T&W Farmiloe Ltd (Vol 14 Appendix E.5, Plate E.10). The southern boundary wall of this block along Cringle Street and the eastern wall along Kirtling Street both have numerous examples of blocked openings, doorways and windows (Vol 14 Appendix E.5, Plate E.11 and E.12). The third and final building of this group lies in the northwest corner of the block and is built with panels of concrete and brick. This appears to be the latest of the group and is likely to be the only one which is post-war in date. This group of buildings is therefore part of only a few surviving, small scale pre-World War II, or 19th century industrial buildings remaining in the area of the site.

7.4.41 These buildings form part of the Nine Elms Lead Works of T.W. Farmiloe Ltd (HEA 1B), which was established in 1886. The lead works extended to the riverside, with docking, unloading and storage facilities on to the Thames. The single-storey buildings on the east side of the block date from 1886–1894, whilst the southern building with the large blocked doorway was added post 1903. Though unlisted these buildings are of sufficient historical interest to be considered of medium significance as heritage assets. The buildings are surviving visible evidence of the industrial past of the area, and with their position and setting, within sight of the landmark Battersea Power Station, they make a positive contribution to the area in evidential terms of past activity in contrast to the surrounding modern commercial buildings.

7.4.42 The industrial building to the north of this block, on the north side of Kirtling Street, occupies the site of the former lead works' riverside buildings. It is of a modern construction, probably built within the last 30–40 years. It occupies a site between Kirtling Street and the Thames, with the northern side of the building adjacent to the riverfront and the building has an open compound to the east. The eastern wall of the compound is a north-south brick wall, with buttresses on the eastern façade, each with a corbel (Vol 14 Appendix E.5, Plate E.14). This is likely to be part of a former industrial building such as a warehouse or factory, and may well be a surviving remnant of the Farmiloe lead works buildings. Due to its fragmentary survival it is considered to be a heritage asset of low significance.

7.4.43 The northwestern part of the site is currently occupied by buildings and a yard which are part of a working concrete batching plant. It mostly comprises open ground to allow for plant movement, with a conveyor running towards a pier located within the northwestern boundary of the site. The few buildings on the landward side of the river wall comprise cabins and a warehouse and office building in the centre of the compound. A tank (one of an original six) is located in the northeastern part of the compound. Historic maps show that the compound did not assume its present layout until the early 1950s. Since that time several of the original buildings have been wholly or partially demolished or replaced with the existing buildings. The remaining warehouse buildings are unlikely to be more than 60 years old. They are of negligible heritage significance and are not considered further in this assessment. The pier to the north of the compound, constructed from wood reinforced with steel piles and a concrete platform, is contemporary with the cement works and is of negligible heritage significance, and not considered further in the assessment.

7.4.44 The block of buildings in the southern area of the site, bordered by Nine Elms Lane to the southeast, Kirtling Street to the southwest and west and Cringle Street to the north are composed of buildings built within the last 30 years which are of negligible heritage significance and are not considered further in this assessment.

7.4.45 At the corner of the very southern tip of the site, on the eastern side of Kirtling Street where it meets Nine Elms Lane, is an unusual and early electricity supply box, with a decorative panel and finial on top (HEA 1F, Vol 14 Appendix E.5, Plate E.15). The front panel has the words "Battersea Borough Council Electricity Supply". Battersea Borough Council was formed in 1900 after the London Government act of 1899. It was abolished in 1965 and incorporated into the London Borough of Wandsworth. This is an item of local interest and historic street furniture and has evidential value. It is considered a heritage asset of low asset significance.

Within the assessment area

Battersea Power Station

7.4.46 The site lies east of the Grade II* Listed Battersea Power Station. The structure, with its four distinctive chimneys, is a highly prominent heritage asset, featuring in views westwards from the Vauxhall Bridge and southwards from the Churchill Gardens Conservation Area and Dolphin Square Conservation Area on the north bank of the river, and from Chelsea Bridge to the west. This is illustrated in Vol 14 Plate 7.4.1 and Vol 14 Plate 7.4.2. It is screened from the Grade II Registered Battersea Park to the west by the presence of intervening modern residential development. Its setting is therefore defined largely by its position on the river frontage, although its immediate setting is characterised by modern industrial use and vacant development plots. The nearer setting of the power station, other than its relationship with the river and the railway viaducts, makes little contribution to its significance as the majority of buildings which once surrounded and served the station are now lost. The site makes a negligible contribution to the setting of the power station when viewed from the river.

Vol 14 Plate 7.4.1 Historic environment – view west from Vauxhall Bridge towards the Kirtling Street development site, with the Battersea Power Station in the distance

Vol 14 Plate 7.4.2 Historic environment – view to west from the Thames path towards Battersea Power Station.

Churchill Gardens Conservation Area

7.4.47 The proposed development site lies 100m from the Churchill Gardens Conservation Area on the opposite bank of the River Thames. The river frontage of the conservation area is characterised by a number of Grade II listed buildings aligned along Grosvenor Road including Nos. 105-109 Grosvenor Road and the Churchill Gardens Estate which is noted for the scale and modernity of its architecture as well as its landscape setting and riverside frontage, forming a prominent and visible landmark from across the River Thames. There are far reaching views out of the conservation area from the river frontage towards the site and the Battersea Power Station and the industrialised southern bank of the Thames at this point. This is illustrated by View of Heritage Value 1 in Vol 14 Figure 7.4.2 (see separate volume of figures) and Vol 14 Plate 7.4.3. However, views to and from the listed buildings are limited by the intervening presence of mature London plane trees that line the embankment. The trees provide strong uniformity to the southern edge of the estate and continue the characteristic riverside planting throughout the city. The setting of the conservation area (including the river) contributes to its high significance. The contribution of the site to this setting is, however negligible due to the distance, intervening trees and buildings and the fact that it is peripheral to more significant views, such as that towards Battersea Power station.

Vol 14 Plate 7.4.3 Historic environment – view to south towards the site from Churchill Gardens Conservation Area

Dolphin Square Conservation Area

7.4.48 The site lies 175m from the Dolphin Square Conservation Area on the opposite bank of the River Thames. The most striking aspect of the character of the Dolphin Square complex is its monumental scale which dominates its immediate surroundings, and is a highly visible landmark on this part of the Thames. However, views from the Dolphin Square Conservation Area are restricted by further development on the north side of Grosvenor Road. This is illustrated by View of Heritage Value 2. There are no listed buildings in the Dolphin Square Conservation Area, which is of high significance. The setting of the Dolphin Square complex contributes moderately to its significance, the main significance of the conservation area, however is the building itself. The site makes a negligible contribution to the significance of the setting, due to the distance and intervening trees and buildings and the industrial character of the southern bank of the Thames at this point.

Construction base case

7.4.49 As detailed in para. 7.3.11, whilst ongoing fluvial erosion is changing the archaeological baseline within the foreshore, since the rate of erosion is not known the base case is assumed to be as per the baseline for the purposes of the assessment. Furthermore, as described in para. 7.3.11, no developments identified within the site development schedule would lead to any loss of or change in buried or above-ground assets within the site. Therefore the base case for the assessment of construction effects on buried and above-ground heritage assets within the site would be the same as at present.

7.4.50 As detailed in para. 7.3.12, the Riverlight Tideway Industrial Estate and the Battersea Power Station schemes would result in a change in the character of the surrounding townscape, increasing the extent, scale and form of residential development along this part of the River Thames. In terms of the setting of Battersea Power Station, distant views to the power station from the opposite side of the River Thames would not be affected and the structure would retain its prominence on the river frontage. There would also be no change to the historic character of the conservation areas which would retain all of their heritage features and setting. Therefore, the base case for the construction phase would remain the same as the baseline.

Operational base case

7.4.51 The base case for Year 1 of operation includes the schemes from the site development schedule (Vol 14 Appendix N) as described in para. 7.3.18. Whilst these would increase the extent, scale and form of development along this part of the River Thames, distant views to Battersea Power Station from the opposite side of the River Thames would not be affected, with the structure retaining its prominence on the river frontage. Furthermore, there would be no change to the historic character of the conservation areas. Therefore, the base case for the operation phase would remain the same as the baseline.

7.5 Construction effects assessment

Buried heritage assets

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

7.5.2 The archaeological impact of the neighbouring Thames Tideway Tunnel sites at Kirtling Street and Heathwall Pumping Station would have effects on a very similar range of archaeological receptors. Although they would result in multiple effects on archaeological remains, the impacts at the two sites would either affect specific remains contained within them or constitute a very small impact on more diffuse landscape features, such as the palaeochannels and eyots of the prehistoric period or 18th and 19th century industrial developments. The effects from both sites are reflected in the assessment below.

Site setup

7.5.3 Preliminary construction works could have a localised impact upon post-medieval remains landward of the river wall. Demolition of the buildings on the site and construction of the works compound on the landward side of the site is likely to entail preliminary site stripping. Site fencing would be erected, supported by timber posts in concrete foundations. Office, storage and welfare facilities would be constructed upon pad foundations.

7.5.4 These activities would have a low magnitude of impact on any surviving late 18th or 19th century remains of low asset significance within the made ground. This would locally reduce the significance of the assets and would constitute a **minor adverse** effect.

Construction of jetty, dredging and scour around temporary structures

7.5.5 Piling for the temporary jetty and overhead conveyors would locally remove any archaeological remains within and around the footprint of each pile. This would cause a localised impact on any assets removed from within the footprints of the piles. Some scour around the piles could also occur during the construction phase.

7.5.6 The use of a jack-up barge for the jetty piling would have a localised impact on archaeological remains within and around the footprint of the barge supports or legs and would also constitute a localised impact on any affected assets.

7.5.7 Within the deep dredged area of the Thames river channel these activities would have no impact since any heritage assets would already have been removed. Elsewhere, any remains within the footprints of the barge legs and piles would be impacted within a limited area, such that the impact would be low in magnitude, resulting in a **minor adverse** effect on each of the assets listed in para. 7.5.10. Any effects from scour would similarly be **minor adverse**.

7.5.8 Dredging on the northwestern side of the existing jetty would be carried out in an area of the channel that has previously been dredged and is therefore unlikely to have an impact on buried heritage.

Construction of the shaft and associated structures

7.5.9 Construction of the shaft would remove any archaeological remains within its footprint. The below-ground air filter chamber and associated ducts and ventilation control structures would partially remove the upper archaeological remains from within its footprint, but would be unlikely to reach the bottom of the alluvium layer.

7.5.10 These construction works would impact upon any archaeological assets present on the foreshore and the environmental effect would depend upon the significance of the assets removed. The level of impact is likely to be high with asset significance reduced to negligible, resulting in the following effects:

a. There is a high potential for palaeoenvironmental remains within the alluvium of low to medium significance. Impacts would result in a **minor adverse** effect.

b. There is a moderate potential for isolated, redeposited prehistoric remains of low asset significance. The removal of such remains would comprise a **minor adverse** effect.

c. There is a moderate potential for evidence of prehistoric activity or settlement of medium significance and for remains of timber structures of high significance. The removal of such remains would comprise a **major adverse** effect.

d. There is a low potential for isolated Roman remains of low asset significance. The removal of such remains would comprise a **minor adverse** effect.

e. There is a moderate potential for early medieval remains, eg, Saxon fish traps, of medium to high asset significance. The removal of such remains would constitute a **major adverse** effect.

f. There is a low potential for later medieval remains associated with reclamation, flood defences and agriculture. Such remains would be of low asset significance. Removal of such remains would constitute a **minor adverse** effect.

g. There is a high potential for post-medieval industrial remains. These would be of low asset significance and their localised removal would constitute a **moderate adverse** effect.

Reconstruction of CEMEX plant

7.5.11 The reconstruction of the CEMEX plant would involve the building of new water tanks and silos, aggregate storage bins and a below-ground aggregate transfer conveyor, all with deep piled foundations. The impact of these piles would be to remove all archaeological remains from the localised area of their footprints and have a further impact on the same potential buried heritage assets as those affected by the construction of the shaft and associated structures, as listed above (para. 7.5.10).

7.5.12 Further water tanks and stone washing and drying bays would be constructed with shallower foundations, assumed for the purposes of this assessment to be 2-3m deep, which would locally remove post-medieval industrial remains of low asset significance. This would constitute a high magnitude of impact, resulting in a **moderate adverse** effect.

Above-ground heritage assets

Physical effects on above-ground heritage assets

7.5.13 Site set up would require the demolition of all above-ground structures. The significance of historic assets affected by the demolition works would be reduced to negligible which would comprise a high magnitude of impact. The environmental effects would depend upon the significance of the affected assets, as follows:

a. The group of 19th/early 20th century buildings associated with the lead works are considered to be of medium asset significance. The removal of these buildings would comprise a **major adverse** effect.

b. The 20th century industrial building which is possibly part of the Farmiloe lead works, in the northwestern part of the site is of low significance and its removal would comprise a **minor adverse** effect.

c. The early electricity supply box with a decorative panel on the pavement at the corner of Kirtling Street and Battersea Park Road, a heritage asset of low significance, would not be removed. There would therefore be **no effect** on this asset.

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

7.5.14 The NPS recognises in para. 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.

Setting of Battersea Power Station

7.5.15 Due to its prominence on the River Thames, the Thames Tideway Tunnel project construction works at both the Kirtling Street site and the Heathwall Pumping Station site, including the presence of cranes, plant, noise shed and gantry, would detract from views to Battersea Power Station from the east, south and west. However, the setting of the building along the south bank of the Thames and inland makes a minimal contribution to the significance of the power station as most of the buildings once integral to and associated with it are now lost. It is also an area of established industrial character. Given the height and scale of Battersea Power Station the impact of visual intrusion of both Heathwall Pumping Station and Kirtling Street would be relatively low. The magnitude of change to its setting would be low, resulting in a **minor adverse** effect.

Setting of Churchill Gardens Conservation Area

7.5.16 The construction works at Heathwall Pumping Station and Kirtling Street, including the presence of cranes, plant, noise shed and gantry, would be visible within views across the River Thames from the river frontage of the Churchill Gardens Conservation Area. However, views from the listed buildings aligned along the north side of Grosvenor Road alongside the river frontage would not be adversely affected due to the intervening presence of mature vegetation. The magnitude of change to the setting of Churchill Gardens Conservation Area would be low, resulting in a **minor adverse** effect.

Setting of Dolphin Square Conservation Area

7.5.17 The presence of construction works on the opposite bank of the River Thames at both Heathwall Pumping Station and Kirtling Street, including the presence of cranes, plant, noise shed and gantry, would detract slightly from broad views from the river frontage of the Dolphin Square Conservation Area. However, the construction works would not detract from direct views towards the Battersea Power Station. The magnitude of change to the setting of Dolphin Square Conservation Area would therefore be low, resulting in a **minor adverse** effect.

Sensitivity test for programme delay

7.5.18 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 in respect of the historic environment reported above. Whilst a greater proportion of the schemes listed in the site development schedule would be complete and occupied this would not materially change the base case against which construction impacts are assessed.

7.6 Operational effects assessment

Above-ground heritage assets

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

Battersea Power Station

7.6.1 The Thames Tideway Tunnel sites features in views toward Battersea Power Station. However, given the limited scale of the operational development at both the Kirtling Street and Heathwall Pumping Station sites, operational development would form a minor part of views to Battersea Power Station from the east, south and west. The new CEMEX silos would be twice the height of the existing structures on the CEMEX site but their distance and placement within an established industrial context would minimise any impact. The magnitude of change to the setting of Battersea Power Station would therefore be negligible, resulting in a **minor adverse** effect.

Sensitivity test for programme delay

7.6.2 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 in respect of the historic environment reported above. A greater proportion of the schemes listed in the site development schedule would be complete and occupied but this would not materially change the base case against which effects are assessed.

7.7 Cumulative effects assessment

Construction effects

7.7.1 For the reasons detailed in para. 7.3.13 no assessment of cumulative physical effects on heritage assets within the site has been undertaken.

7.7.2 The presence of construction works at the Kirtling Street site adjacent to the development schemes described in para. 7.3.14 would give rise to limited adverse cumulative effects on the historic character and setting of Battersea Power Station and the setting of the Dolphin Square and Churchill Gardens conservation areas on the opposite bank of the River Thames. However, this would not elevate the significance of effect over and above the effect from the Thames Tideway Tunnel project site alone as Battersea Power Station would remain visible and prominent.

Operational effects

7.7.4 For the reasons detailed in para. 7.3.19 there would be no likely significant cumulative effects on the character and setting of historic assets during the operational phase.

Sensitivity test for programme delay

7.7.5 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, a greater proportion of the schemes set out in the site development schedule would be built and occupied with a corresponding reduced level of cumulative construction activity. However, this would not materially change the assessment presented above.

7.8 Mitigation

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

Buried heritage assets

7.8.2 Based on this assessment, no heritage assets of high significance are anticipated that would merit a mitigation strategy of permanent preservation *in-situ*. It is therefore considered that the minor to major environmental effects of the proposed development could be successfully mitigated by a suitable programme of archaeological investigation before 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, foreshore walkover survey and monitoring 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. 7.8.6 below.

7.8.4 Subject to the findings of any subsequent field evaluation in advance of construction, mitigation of the adverse effects upon archaeological remains within the site could include the following:

a. An archaeological watching brief during site preparation and construction to mitigate impacts upon remains of low asset significance arising from foundations for offices and welfare facilities on the landward side of the existing river wall. A watching brief would also be undertaken to observe and record any remains of low asset significance which might be affected by the shallower works associated with the reconstruction of the CEMEX operating plant

b. Archaeological survey and excavation of the foreshore, within and around the footprints of the proposed temporary jetty structures and construction activities in order to mitigate the effects on the river side of the existing river wall. The precise approach to survey and excavation would depend on the detailed construction methodology.

c. Due to the depth of alluvium on the site, mitigation of the impacts of the drive shaft, air filter and ventilation shaft would only become feasible following the insertion of the perimeter walls and shaft segments of each construction (the shaft, the chamber, etc). Targeted archaeological investigation would proceed as the ground within the perimeter walls and shaft is excavated downwards.

d. Mitigation of the impact of the deeper piled foundations for the CEMEX plant reconstruction works would also take the form of targeted excavation or a watching brief, where feasible within the areas affected, to be arranged in accordance with the results of archaeological evaluation and previous work.

7.8.5 Similar programmes of physical data collection would be carried out at Kirtling Street and Heathwall Pumping Station, and dissemination of the results from the two sites could be combined.

7.8.6 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.

7.8.7 Construction phase scour around the temporary piled jetty would be mitigated through a programme of monitoring and the provision of scour protection if required, as detailed in the *CoCP* Part A (Section 12).

Above-ground heritage assets

7.8.8 A programme of standing structure survey and photographic recording before demolition would mitigate the major adverse effect of removal of the group of 19th/early 20th century buildings associated with the lead works. Assets of different significance would require different levels of survey as detailed in the English Heritage specifications (English Heritage, 2006)[4]:

a. The 20th century building would require a programme of standing structure survey and photographic recording, equivalent to Level 2 of the specifications.

b. The late 19th/early 20th century buildings associated with the former lead works would require a Level 3 programme of standing structure survey and recording.

7.8.9 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 para. 7.2.9. As no significant adverse effects are predicted, no further mitigation during construction or operation is proposed.

7.9 Residual effects assessment

Construction effects

7.9.1 Whilst the NPS (para 4.10.19) considers that a documentary record of a heritage asset is not as valuable as retaining the heritage asset, it has been agreed with English Heritage that preservation by record and the enhancement of understanding of asset significance is in this case satisfactory mitigation. With the mitigation described above in place, the residual effects on all buried and above-ground heritage assets would be negligible. All residual effects are presented in Section 7.10.

7.9.2 As no mitigation measures are required for effects on the historic character, appearance and setting of above-ground heritage assets, 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

7.9.3 As no mitigation measures are required for effects on the historic character, appearance and setting of above-ground heritage assets beyond those embedded in the proposed development, 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 14 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				
High potential for palaeoenvironmental remains within the alluvium (Low or medium asset significance)	Assets removed by construction of the drive shaft, culverts and chambers, and deep piled foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible locally.	Minor adverse	Archaeological excavation and recording in the area of the main drive shaft and ventilation structures to form preservation by record. Archaeological excavation and recording or watching brief in the area of the deep piled CEMEX plant foundations.	Negligible
	Assets removed by construction of foreshore jetty and scour around temporary structures Asset significance reduced locally.	Minor adverse	Foreshore survey, watching brief and environmental sampling.	Negligible
Moderate potential for isolated, redeposited prehistoric finds (Low asset significance)	Assets removed by construction of the drive shaft, culverts and chambers, and deep piled foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible locally.	Minor adverse	Archaeological excavation and recording in the area of the drive shaft and ventilation structures to form preservation by record. Archaeological excavation and recording or watching	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
			brief in the area of the deep piled CEMEX plant foundations.	
	Assets removed by construction of foreshore jetty and scour around temporary structures.	Minor adverse	Foreshore survey, watching brief and environmental sampling.	Negligible
Moderate potential for prehistoric activity or settlement (including possible timber structures) (Medium to high asset significance)	Assets removed by construction of the drive shaft, culverts and chambers, and deep piled foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible locally.	Major adverse	Archaeological excavation and recording in the area of the main drive shaft and ventilation structures to form preservation by record. Archaeological excavation and recording or watching brief in the area of the deep piled CEMEX plant foundations.	Negligible
	Assets removed by construction of foreshore jetty and scour around temporary structures. Asset significance reduced locally.	Minor adverse	Foreshore survey, watching brief and environmental sampling	Negligible
Low potential for isolated Roman remains (Low asset significance)	Assets removed by construction of the drive shaft, culverts and chambers, and deep piled foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible locally.	Minor adverse	Archaeological excavation and recording in the area of the main drive shaft and ventilation structures to form preservation by record. Archaeological excavation and recording or watching	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
			brief in the area of the deep piled CEMEX plant foundations.	
	Assets removed by construction of foreshore jetty and scour around temporary structures Asset significance reduced locally.	Minor adverse	Foreshore survey, watching brief and environmental sampling	Negligible
Moderate potential for early medieval (Saxon) fish traps or other remains (Medium to high asset significance)	Assets removed by construction of the drive shaft, culverts and chambers, and deep piled foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible locally.	Major adverse	Archaeological excavation and recording in the area of the main drive shaft and ventilation structures to form preservation by record. Archaeological excavation and recording or watching brief in the area of the deep piled CEMEX plant foundations.	Negligible
	Assets removed by construction of foreshore jetty and scour around temporary structures. Asset significance reduced locally.	Minor adverse	Foreshore survey, watching brief and environmental sampling	Negligible
Low potential for remains of later medieval reclamation and flood defence (Low asset significance)	Assets removed by construction of the drive shaft, culverts and chambers, and deep piled foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible	Minor adverse	Archaeological excavation and recording in the area of the main drive shaft and ventilation structures to form preservation by record. Archaeological excavation	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	locally.		and recording or watching brief in the area of the deep piled CEMEX plant foundations.	
	Assets removed by construction of foreshore jetty and scour around temporary structures. Asset significance reduced locally.	Minor adverse	Foreshore survey, watching brief and environmental sampling	Negligible
High potential for post-medieval 18th and 19th century remains, including the footings of industrial buildings and yards, former river walls, infilled docks and barge beds (Low asset significance)	Assets removed by construction of the drive shaft, culverts and chambers, and deep piled foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible locally.	Moderate adverse	Archaeological excavation and recording in the area of the main drive shaft and ventilation structures to form preservation by record. Archaeological excavation and recording or watching brief in the area of the deep piled CEMEX plant foundations.	Negligible
	Assets removed by site set-up and shallow foundations for the reconstruction of the CEMEX plant. Asset significance reduced to negligible locally.	Minor adverse	Archaeological excavation and recording in the area of the main drive shaft and ventilation structures and shallow CEMEX reconstruction works foundations to form preservation by record.	Negligible
	Assets removed by construction of	Minor	Foreshore survey, watching	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	foreshore jetty and scour around temporary structures Asset significance reduced locally.	adverse	brief and environmental sampling	
Above-ground heritage assets				
Group of late 19th/early 20th century industrial brick buildings in the centre of the site (T&W Farmiloe Ltd lead works) (Medium asset significance)	Demolition of the buildings. Asset significance reduced to negligible.	Major adverse	Standing structure recording and photographic survey to English Heritage survey level 3 to form preservation by record	Negligible
Late 20th century industrial building in the northern part of the site (possible Farmiloe lead works) (Low asset significance)	Demolition of the buildings. Asset significance reduced to negligible.	Minor adverse	Standing structure recording and photographic survey to English Heritage survey level 2 to form preservation by record	Negligible
Battersea Power Station (High asset significance)	The presence of construction works at the Kirtling Street site and Heathwall Pumping Station site within the periphery of significant views would have a low magnitude of change on the setting of Battersea Power Station, with the magnitude tempered by the scale	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and design principles	Minor adverse

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	and mass of the structure.			
Churchill Gardens Conservation Area (High asset significance)	Construction works would detract slightly in views out of the conservation area.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and design principles	Minor adverse
Dolphin Square Conservation Area (High asset significance)	Construction works would detract slightly in views out of the conservation area.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and design principles	Minor adverse

Vol 14 Table 7.10.2 Historic environment – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Battersea Power Station (High asset significance)	The limited scale of the development would lead to a negligible magnitude of change to the setting of Battersea Power Station.	Minor adverse	No mitigation required further to that embodied within the proposed design and design principles	Minor adverse

References

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

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

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

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

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

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Volume 14: Kirtling Street site assessment

Section 8: Land quality

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Thames Tideway Tunnel

Environmental Statement

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

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

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

a. Section 13 - Water resources – groundwater assesses the likely significant effects to water resources from soil, perched water and groundwater contamination. The land quality assessment considers potential risks to human health receptors (eg, construction workers) from contaminated perched water and groundwater, including free phase[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, for example, the generation of dust and soil vapour from exposed ground and soils during construction.

c. Section 5 Ecology – aquatic and Section 14 Water resources – surface water consider the mobilisation of sediments associated with in-river construction and how this would impact upon the ecology and quality of water in the tidal Thames. The surface water section also considers the likely significant effects to controlled waters from land contamination (eg, contaminated run-off) and use of contaminating substances during construction. No further assessment is made in the land quality section.

[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.

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 phase (refer to Vol 14 Section 8.2 and Vol 2 Section 8.6) and the nature of the proposals would ensure that no operational effects remain (the likely significant effects from seepage from the shaft and tunnel are assessed as part of the groundwater assessment Vol 20 Section 13). 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 for Waste Water (Defra , 2012)[1] section 4.8. The risk posed by construction on previously developed land is addressed in the following assessment and through measures embedded in the *Code of construction practice* (*CoCP*) (further details can be found in Vol 2 Section 8.3). The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

8.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling 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. demolition, removal and, in some cases, replacement of a number of existing on-site buildings

b. construction of a temporary piled jetty and temporary cofferdam, crane bases and other foundations

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

d. main tunnel shaft, the invert of which would be located at a depth of approximately 48m below ground level (bgl), and associated maintenance access

e. main tunnel drive towards Chambers Wharf site

f. main tunnel drive towards Carnwath Road site

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

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

8.2.4 An area would also be required within the site for construction logistics, such as materials handling and storage areas, concrete batching, segment storage and site welfare and offices (as shown in Kirtling Street site construction plans - see separate volume of figures).

Code of construction practice

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

8.2.6 There are no *CoCP Part B* measures which are relevant to this land quality assessment.

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

Pre-construction

8.2.8 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 14 Appendix F.1) and production of an initial conceptual site model

b. undertaking of specialist site surveys, such as Japanese Knotweed and desk study for UXO risk, which to date has included a site-specific desk study for part of the Kirtling Street site to inform ground investigation work (see Vol 14 Appendix F.3)

c. completion of intrusive site investigation within specific site areas where access is available.

8.2.9 In addition to the above, land quality will continue to be assessed via the following measures:

a. preparation of a preliminary risk assessment, design of a ground investigation rationale and ground investigation survey 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 criteria for soil material to be permanently placed at the site.

8.2.10 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

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

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

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

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

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

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

8.2.13 Environmental monitoring would include the following measures:

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

b. dust and air/vapour monitoring (see *CoCP Part A* 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 Kirtling Street had been identified as a preferred site. The scope for the assessment of land quality at this site has therefore drawn on the scoping response from the LB of Wandsworth in relation to other sites and is based on professional judgement as well as experience of similar sites.

8.3.3 The LB of Wandsworth was specifically consulted with respect to land quality data they hold at the site and surrounding area. Information, including a summary of current and historical land-uses in the area, and ground investigation data for the Battersea Power Station, was provided by the LB of Wandsworth and is discussed further in Vol 14 Appendix F.1 and Vol 14 Appendix F.2.

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 limit 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 takes into account the schemes described in Vol 14 Appendix N. The baseline is likely to change substantially between the base case year and Site Year 1 of construction (2016). There are five proposed developments within the 250m buffer (as shown in Vol 14 Table 8.3.1) which are likely to be complete and operational before the commencement of the construction phase and as a result form part of the construction base case.

8.3.9 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 are included within the cumulative effect assessment and are also identified in Vol 14 Table 8.3.1.

Vol 14 Table 8.3.1 Land quality – construction base case and cumulative assessment development (2016)

Development	Distance from site	Construction base case	Cumulative impact assessment
Battersea Plant, Nine Elms Lane, Goods Yard, Cringle Street (installation of additional concrete batching plant, aggregate feed hopper and cement silos, following this redevelopment for site operations associated with the Thames Tideway Tunnel project)	On-site	✓	✘
Nine Elms Pier (demolition of existing pier and erection of new marina to provide permanent moorings for 33 houseboats and 2 moorings for visitor boats, in addition to construction of a studio,/office building)	On-site/adjacent	✓	✘
Riverlight Tideway Industrial Estate (redevelopment of the site to provide residential/mixed use development which includes commercial, retail, financial and professional services – blocks, B,C,D,E and F)	Adjacent	✓	✘
Battersea Power station (conversion to provide retail, residential flats, business, cultural, hotel and conference space – phase 1 and 2)	55m west	✓	✘
Embassy Gardens, Nine Elms Lane, DHL Depot, 1-12 Ponton Road and 51 Nine Elms Lane (redevelopment of existing site for residential use, community use, leisure use, retail, financial and professional services - buildings A09, A10 and A11)	130m east	✓	✘
Riverlight Tideway Industrial Estate (redevelopment of the site to provide residential/mixed use development which includes commercial, retail, financial and professional services – block A)	Adjacent	✘	✓
Post Office depot, South London Mail Centre, Nine Elms Lane (demolition	20m east	✘	✓

Development	Distance from site	Construction base case	Cumulative impact assessment
of existing buildings and construction of mixed use development- plots, B, C and D)			
Battersea Power station (conversion to provide retail, residential flats, business, cultural, hotel and conference space – phases 3, 4, 5 and 6)	55m west	✗	✓
Embassy Gardens, Nine Elms Lane, DHL Depot, 1-12 Ponton Road and 51 Nine Elms Lane (redevelopment of existing site for residential use, community use, leisure use, retail, financial and professional services - buildings A01, A02, A03, A04, A05 and A07)	130m east	✗	✓

Symbols ✓ applies ✗ does not apply

8.3.10 Section 8.5 details the likely significant effects arising from the construction at the Kirtling 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 given in Vol 2 Section 8.4 and 8.5.

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 Land quality.

Assumptions and limitations

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

Assumptions

8.3.17 It is assumed that the area within the LLAU would have been affected by the legacy of industrial use and that contamination may be present. The assessment has assumed that a cover of Made Ground is present across the site.

8.3.18 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 the wider site).

8.3.19 The site is expected to be underlain at depth by low permeability London Clay deposits which are in turn underlain by further low permeability deposits associated with the Lambeth Group. Therefore, it has been assumed that any potential contamination (if any) is likely to be restricted to the overlying shallow deposits (ie, Made Ground and River Terrace Deposits).

Limitations

8.3.20 The walkover survey was conducted from publicly accessible areas.

8.3.21 There is no site-specific data on soil or groundwater quality data presently available for the main site. Ground investigations are ongoing and will form part of the baseline to the remediation strategy.

8.3.22 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 drawn upon in this assessment is presented in Vol 2.

8.4.3 A baseline report is presented in Vol 14 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 14 Appendix F.1, this section should also be read in conjunction with Vol 14 Figure F.1.1, Vol 14 Figure F.1.2 and Vol 14 Figure F.1.3 (see separate volume of figures).

Summary of baseline conditions

Geology

8.4.4 The site is underlain by a cover of Made Ground extending to approximately 4.5m bgl. The Made Ground is underlain, in turn, by Alluvium, River Terrace Deposits, London Clay Formation, Harwich Formation and the various subgroups of the Lambeth Group which are anticipated to be present at the base of the proposed structure (See Vol 14 Appendix F Table F.3 for the full geological succession).

8.4.5 The Made Ground and Alluvium would be absent from the works in the foreshore.

Contamination

8.4.6 The site is located within an industrial area that has a long legacy of a variety of industrial uses dating from the late 19th Century. The site has been subject to a number of potentially contaminative historical land-uses such as paint and colour works, depots, warehousing, and a garage and associated fuel filling station. Current on-site potentially contaminative land-uses mainly comprise an existing concrete batching works.

8.4.7 A cover of Made Ground (potentially of variable thickness and quality) is present across the site which also represents a potential source of contamination.

8.4.8 The surrounding area immediately to the west and south has previously supported potentially contaminative land-uses including: a waste transfer station, the former Battersea power station, further to the west, and extensive former gas works to the southeast.

8.4.9 Investigations at and in the vicinity of the site have recorded the Made Ground soils to be typical of such soils in older urban industrialised area, and show the Made Ground to be impacted by lead and PAHs.

8.4.10 Additionally elevated metals and hydrocarbons have been recorded in groundwater samples which reflect the poor water quality of an urban setting.

8.4.11 The main potential contaminants of concern associated with the historical land-uses include those that have been recorded (heavy metals (eg lead), polyaromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH)), as well as volatile organic compounds (VOCs), cresols and phenols.

8.4.12 These contaminants may be hazardous to human health (eg, as irritants or carcinogens or by their volatile or flammable properties) depending on the potential concentration of the substance. Certain (volatile) contaminants may also be present in the vapour phase in soils.

UXO

8.4.13 A desk based assessment for UXO threat was undertaken by 6 Alpha Associates Limited at the Kirtling Street site (see Vol 14 Appendix F.3)[3]. The report reviews information sources such as the Ministry of Defence (MoD), Public Records Office and the Port of London Authority (PLA).

8.4.14 The assessment covered two areas within the Kirtling Street site (Area A – land aspect of the main work area and Area B – foreshore and river of main work area).

8.4.15 The report advises that there were three high explosive bomb strikes within Area A and seven within the buffered site boundary. In addition, a further 13 strikes were recorded within 100m of the buffered site boundary and a V1 strike occurred within the eastern section of Area A.

8.4.16 The report also states that the site has not been noticeably developed since WWII and as such, it is unlikely that buried UXO items would have been removed through previous development.

8.4.17 Taking into account the findings of this study and the known extent of the proposed works at the Kirtling Street site, it was considered that within Area A there is an overall medium/high threat from UXO and within Area B there is a high threat from UXO.

Summary of receptors

8.4.18 The receptors identified at this site from the baseline survey (see Vol 14 Appendix F.1) and their corresponding sensitivity following the criteria set out in Vol 2 are as follows:

a. construction workers: low sensitivity for general above ground site workers such as staff in site offices or delivery drivers and high sensitivity for those site workers involved in below ground excavation works and associated activities

b. adjacent land-users: residents (high sensitivity), and workers on the adjacent industrial/commercial land and Thames Path users (low sensitivity)

c. built environment: low sensitivity for adjacent commercial and light industrial units and unlisted river wall and high sensitivity for the listed Battersea Power Station.

Construction base case

8.4.19 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* 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, problematic or gross contamination, which may substantially hinder the construction programme or which cannot be adequately dealt with in a controlled manner during construction, would be remediated prior to the commencement of the main construction works (such as the main tunnel and shaft excavation and in other areas of proposed excavation, where necessary). This would also include mobile free phase that poses a risk to off-site receptors via vapour migration.

8.5.3 Since the approach to remediation cannot be defined at this stage, it is assumed that some contamination would remain. Therefore, some contamination is considered to be present for the purposes of this assessment.

8.5.4 Unless there are any immediate (as yet unknown) unacceptable risks elsewhere (for instance off-site migration of mobile free phase hydrocarbons or vapour risk to adjacent properties), remediation in areas away from planned intrusive construction works would not take place prior to construction.

Development of conceptual model

Interactions between source-pathway-receptor

8.5.5 The following sections outline how the contamination sources summarised in paras. 8.4.6 to 8.4.12 may interact with the receptors identified during the construction phase (see para.8.4.18) 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 14 Table 8.5.1 Land quality – source-pathway-receptor summary (construction) below. 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 14 Table 8.5.1 Land quality – source-pathway-receptor summary (construction)

Receptors / Generic sources	Construction workers	Adjacent land-users	Built environment
Contaminated soils / sediments	Inhalation, dermal contact, ingestion	Wind-blown dust and vapour migration (and subsequent ingestion and inhalation)	N/A
Contaminated groundwater or liquids	Inhalation, dermal contact, ingestion	N/A	N/A
Soil gases / vapours	Inhalation	Vapour migration (and subsequent inhalation)	N/A
UXO	UXO 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 existing land quality conditions at the site.

8.5.9 The assessment focuses on those linkages between sources, pathways and receptors that could generate significant effects and is based on available information and professional judgement.

Construction workers

8.5.10 A number of embedded measures set out in the *CoCP* 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 see Vol 14 Appendix F.3) and a proportional response to this risk. With a high risk site such as Kirtling Street this is likely to include 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 a 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*, 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* Part A.

8.5.22 With these measures in place the overall magnitude of the impact to all adjacent land-users is assessed to be negligible.

8.5.23 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the adjacent light industrial/commercial land users and a **minor adverse** effect on the adjacent residential land users (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).

UXO

8.5.24 Impacts on adjacent land-users could occur via accidental detonation of UXO during below ground works. Embedded measures are set out in the *CoCP*, such as the use of specialised UXO contractors offering site-specific advice and where necessary on-site monitoring. These measures are designed to effectively manage any impacts to the adjacent land-users associated with the construction phase of the proposed development.

8.5.25 With these measures in place the overall magnitude of the impact to all adjacent land-users is assessed to be negligible.

8.5.26 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the adjacent light industrial/commercial land users and a **minor adverse** effect on the adjacent residential land users (although the effect is defined as minor adverse, it is considered unlikely that the 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*, 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 to the adjacent residential and non-listed commercial/industrial buildings and river wall and a **minor adverse** effect for the Grade II listed Battersea Power Station (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 14 Appendix N, which could potentially give rise to cumulative effects with the proposed development at Kirtling Street, four developments have been identified (see Vol 14 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*.

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. 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 14 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)	Heath effects from exposure to contaminated soils, sediment, liquids, soil gases / vapours	Negligible	None	Negligible
	Health effects from detonation of UXO	Negligible	None	Negligible
Construction workers – below ground site staff (High)	Heath effects from exposure to contaminated soils, sediment, 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 (Low)	Heath effects from exposure to wind-blown dust or vapours	Negligible	None	Negligible
	Health effects from detonation of UXO	Negligible	None	Negligible
Adjacent land-users residential (High)	Heath effects from exposure to wind-blown dust or vapours	Minor adverse	None	Minor adverse*
	Health effects from	Minor adverse	None	Minor adverse*

Receptor (sensitivity)	Effect	Significance of effect	Mitigation	Significance of residual effect
	detonation of UXO			
Built environment – residential, commercial and light industrial units and river wall (Low)	Damage to structures from detonation of UXO	Negligible	None	Negligible
Built environment – Grade II listed Battersea Power Station (High)	Potential damage to 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] 6 Alpha Associates Limited. Detailed Unexploded Ordnance Risk Assessment. Study site: Work area PWH11 – Kirtling Street (2012).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

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Environmental Statement

Volume 14: Kirtling 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 Kirtling Street site.

9.1.2 The proposed development has the potential to affect noise and vibration levels at receptors due to:

a. construction site activities (noise and vibration)

b. construction traffic on roads outside the site (noise)

c. tugs pulling river barges conveying materials to and from the site (noise)

d. operation of the proposed development (noise and vibration)

9.1.3 Each of these is considered within the assessment.

9.1.4 The development at Kirtling Street is the drive site for two of the main tunnel drives, to Chambers Wharf and Carnwath Road. Groundborne noise and vibration from the tunnelling activities associated with the main tunnel, long connection tunnels and certain short connection tunnels are considered in Volume 3 Project-wide effects assessment.

9.1.5 The assessment of noise and vibration presented in this section has considered the requirements of the National Policy Statement for Waste Water Section 4.9 (noise and vibration) (Defra, 2012)[1]. Further details of these requirements can be found in Volume 2 Environmental assessment methodology Section 9.3.

9.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling 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 During construction, main tunnel secondary lining aggregates would be delivered to site by barge and excavated material from the main tunnel would be removed from the site by barge. For the noise assessment it has been assumed that 90% of these materials would be taken by river. This allows for periods that the river is unavailable and material unsuitable for river transport. All other materials would be transported by road.

Estimated barge and vehicle numbers are presented in Vol 14 Sections 3.3 and 12.2.

Construction activities

9.2.3 Vol 14 Section 3.3 sets out the assumed construction duration and programme for the Kirtling 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 (including Cemex site reconfiguration)
c. demolition
d. diaphragm wall construction
e. shaft construction
f. main tunnel drives
g. main tunnel secondary lining
h. shaft secondary lining
i. 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 14 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 (core) hours (08:00-18:00 weekdays and 08:00-13:00 Saturdays) as identified in the *Code of Construction Practice* (*CoCP)*.
b. extended working hours (18:00-22:00 weekdays, 13:00-17:00 Saturdays) to complete large concrete pours. These are assumed approximately twice a week during the diaphragm walling which occurs for approximately three months and then once a month for other major concrete pours.
c. continuous working (24 hours a day, 7 days a week) during the main tunnel drive for a period of approximately 26 months and main tunnel secondary lining for a period of approximately 11 months.

Code of Construction Practice

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

9.2.8 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 to 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 of a height and extent to achieve appropriate noise attenuation.

9.2.9 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

b. the construction area around the main shaft would be covered by an enclosure / building (clad to a specified sound reduction value) during the main tunnel construction and secondary lining works

c. the building openings would be designed to be away from sensitive noise receptors and would be kept closed when not in use at night

d. compaction of material during demolition would be undertaken using machinery generating the lowest practicable vibration levels which still enables the required level of compaction to be completed. Specifically, the use of large twin-drum vibrating rollers would only occur on occasions where vibration levels can be controlled to less than the impact criteria

e. the concrete batching plant, grout plant, conveyors to load barges and storage / handling areas, would be enclosed with suitable structure acoustic attenuation materials

f. movement of vehicles onsite outside of standard hours would be restricted

Operation

9.2.10 A ventilation structure would be constructed to contain plant and to house the ventilation columns. The operational plant installed would have the potential to create noise impacts, and these are considered in the assessment.

9.2.11 During operation of the tunnel there would be no storm water flow through the drop shaft but there would be flow through the tunnel at the bottom of the shaft. It is considered that noise generated by this movement of water would not be discernable from the surface and as such, this has not been considered in the assessment.

9.3 Assessment methodology

Engagement

9.3.1 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 noise and vibration are presented here.

9.3.2 The survey methodology and monitoring locations, and the limits for plant noise from the operation of the site were agreed with LB of Wandsworth.

9.3.3 Westminster City Council was also consulted regarding limits for plant noise from the operation of the site and these were agreed with the council (see para. 9.3.20).

9.3.4 Written confirmation on the survey methodology was received from LB of Wandsworth in May 2011.

9.3.5 Consultation comments relevant to this site for the assessment of noise and vibration are presented in Vol 14 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 14 Table 9.3.1 Noise and vibration – consultation comments

Organisation	Comment	Response
LB of Wandsworth, phase two response, February 2012	Conveyors are expected to be fully enclosed to minimise noise and prevent spillage of material onto the foreshore or into the River Thames. This is not mentioned in any level of detail at this stage but needs to be raised as an issue.	The *CoCP* requires that conveyors and the conveyor drive motors are enclosed, alongside relevant items of static plant.

Baseline

9.3.6 The baseline methodology follows the methodology provided in Vol 2 Section 9. There are no site specific variations for this site.

Construction

9.3.7 The assessment methodology for the construction phase follows that described in Vol 2 Section 9. There are no site specific variations for undertaking the construction assessment of this site.

9.3.8 Section 9.5 details the likely significant effects arising from the construction at the Kirtling Street Foreshore. The Thames Tideway Tunnel project development at Heathwall Pumping station is close enough to give rise to additional effects on noise within the assessment area for this site but not vibration, and the cumulative effects of the Kirtling Street and Heathwall Pumping Station sites are considered in this assessment.

9.3.9 The construction noise and vibration assessment has considered the effects across the whole duration of the construction phase and the worst-case exposure levels are reported.

9.3.10 Of the schemes outlined in the site development schedule (Vol 14 Appendix N) the following are considered relevant to the construction assessment base case as they are assumed to be complete and operational before or during the Thames Tideway Tunnel project construction period:

a. Battersea Power Station redevelopment – blocks RS-1, PS, RS-4, and O-1

b. Riverlight – Blocks B to F inclusive (Block A would be complete in Site Year 3)

9.3.11 At the Battersea Power Station redevelopment, blocks PS, RS-4 and O-1 have been considered in the assessment, however RS-1 has not been considered directly as it would be screened from the site by block PS.

9.3.12 At the Riverlight development, Block C would screen blocks D to F inclusive, and as such only Blocks A, B and C have been considered here.

9.3.13 Of the schemes outlined in the site development schedule (see Vol 14 Appendix N) the following are considered relevant to the cumulative construction assessment as they are assumed to be under construction at the same time as the Thames Tideway Tunnel project:

a. Battersea Power Station redevelopment – blocks RS-2 and RS-5

b. Riverlight – Block A

c. Nine Elms Parkside development

d. Embassy Gardens

e. Northern Line Extension

f. New Covent Garden Market.

9.3.14 The New Covent Garden Market development will be developed over a number of sites. The 'Northern Site' or 'Flower Market' lies approximately 300m east of the Kirtling Street Site, and so has not been considered here. The majority of the main 'Market site' lies to the south of the existing railway line. A section of the main site however lies closer to the Kirtling Street site to the north of the railway lines, (the 'Entrance Site'), and this section will be developed on land where a residential receptor currently exists (33 Nine Elms Lane). 33 Nine Elms Lane has been assessed as a receptor during Year 1 only, after which it would demolished as part of the construction of the New Covent Garden Market development.

9.3.15 All other schemes in the site development schedule (see Vol 14 Appendix N) are outside of the screening distance of 300m, or screened by a receptor already assessed and are therefore not considered in this assessment.

9.3.16 Traffic flows on construction traffic routes have been examined to determine if there are any routes where there is the potential for traffic noise changes of 1dB(A) or more. This is according to the flow, speed or composition change criteria specified in Vol 2 Section 9. 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. 9.5.78.

9.3.17 The assessment of construction effects also considers the extent to which the effects on noise and vibration would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Construction assessment area

9.3.18 As described in Vol 2 Section 9 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 receptors.

Operation

9.3.19 The operational phase assessment methodology follows the methodology provided in Vol 2 Section 9. Site specific variations to this methodology are set out below. All residential receptors at this site fall within the LB of Wandsworth and City of Westminster and the requirements of these local authorities have been taken into account.

9.3.20 For this site, both LB of Wandsworth and Westminster City Council require that noise emissions from this type of source are designed to meet a rating level (as defined in BS4142[2]) which is 10dB below the typical background noise level over the operational period of the plant at 1m from the façade of the nearest residential receptor. It has been assumed that the reconfigured Cemex works site would be required to meet its existing commitments with regards to operational noise levels from the facility and noise mitigation measures (see para. 9.3.31).

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

9.3.22 Section 9.6 details the likely significant effects arising from the operation of the Kirtling Street site. Although the Thames Tideway Tunnel project development at Heathwall Pumping Station is within 200m, all operational noise sources at the Heathwall Pumping Station would be screened by intermediate buildings at the receptors near Kirtling Street. Therefore, no other Thames Tideway Tunnel project sites are considered in this assessment.

9.3.23 Of the schemes outlined in the site development schedule (see Vol 14 Appendix N) the following are considered relevant to the operational assessment base case as they are assumed to be complete and operational during Year 1 of the operational period:

a. Battersea Power Station development – blocks RS-1, PS, RS-4, O-1, RS-5 and RS-2

b. Riverlight (all blocks)

c. Nine Elms Parkside site redevelopment (Block A)

d. Embassy Gardens (all blocks)

e. New Covent Garden Market, B1 to B6 inclusive and Site Entrance.

9.3.24 All other schemes in the site development schedule (see Vol 14 Appendix N) are outside of the screening distance of 300m, or screened by a receptor already assessed and are therefore not considered in this assessment.

9.3.25 There are no developments identified in Vol 14 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.

9.3.26 Based on the traffic flow, speed or composition change criteria specified in Vol 2 Section 9, there are no routes where potential for operational traffic noise effects would occur.

9.3.27 The assessment of operational effects also considers the extent to which the effects on noise and vibration would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Operational assessment area

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

Assumptions and limitations

9.3.29 The generic assumptions and limitations associated with this assessment are presented in Vol 2 Section 9. The site specific assumptions and limitations are presented in the following section.

Assumptions

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

9.3.31 It has been assumed that the noise from the operation of the reconfigured Cemex site would be the same as or lower than the existing Cemex facility. It has also been assumed that the reconfigured Cemex works site would be required to meet its existing commitments with regards to operational noise levels from the facility and noise mitigation measures.

Limitations

9.3.32 The Cemex facility was not in operation when the night-time noise surveys were undertaken. Despite the omission of this noise source from the baseline noise measurements the assessment is considered robust and the baseline noise survey data present a reasonable worst case (see para. 9.4.13).

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 14 Appendix G.1. Vol 14 Table 9.4.1 below shows that the noise levels are primarily influenced by noise from traffic on Nine Elms Lane and from more distant traffic. During the daytime, the measured levels also included noise from the adjacent Cemex site. The measured night-time noise levels were undertaken when the Cemex facility was not in operation (see para. 9.3.32).

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 14 Table 9.4.1 below (and shown in plan view in Vol 14 Figure 9.4.1 – see separate volume of figures). These were selected as they are representative of the range of noise climates where sensitive receptors are situated around the site. The approximate number of residential properties affected at each location (where known) is indicated in Vol 14 Table 9.4.2.

9.4.5 When construction activities begin, the nearest residential receptors to the site (within the LB of Wandsworth) would be the Nine Elms Pier houseboats to the northeast of the site. Other residential receptors in the close vicinity of the site include Battersea Power Station development blocks PS and O1 to the west, 33 Nine Elms Lane to the south and Riverlight blocks B and C, and Elm Quay to the east. Also considered are Shelly House and River Lodge, on the opposite bank of the Thames in the City of Westminster.

9.4.6 After two years of construction works at the development, it has been assumed that the Battersea Power Station development block RS4 to the southwest and Riverlight block A to the east would be complete.

9.4.7 Beyond these closest receptors there are other residential locations, which are screened from the site by intervening buildings, or are located further from the site than the buildings included in the assessment. These include Keats House, Veridian Apartments, Thessaly House, and Blocks D-F of the Riverlight development which have been considered as secondary receptors in the assessment.

Receptor sensitivity

9.4.8 The noise and vibration sensitive receptors have been assessed according to their sensitivity, using the methodology outlined in Vol 2

Section 9.4. The sensitivities of all assessed receptors are presented in Vol 14 Table 9.4.1.

Vol 14 Table 9.4.1 Noise and vibration – sensitive receptors and noise levels

Ref	Receptor addresses	Sensitivity	Local authority	Measured average ambient noise level, day/ evening/ night, dBL_{Aeq}*	Noise survey location
KS1	Shelley House (residential)	High	City of Westminster	75/74/67	KST03
KS2	Nine Elms Pier Houseboats (residential)	High	LB of Wandsworth	67/67/61	KST02
KS3	River Lodge (residential)	High	Westminster City Council	75/74/67	KST03
KS4	Elm Quay (residential)	High	LB of Wandsworth	68/65/62	HEA02
KS5	Riverlight Block A (residential)	High	LB of Wandsworth	67/67/61	KST02
KS6	Riverlight Block B (residential)	High	LB of Wandsworth	67/67/61	KST02
KS7	Riverlight Block C (residential)	High	LB of Wandsworth	67/67/61	KST02
KS8	33 Nine Elms Lane/New Covent Garden Market Site Entrance** (residential)	High	LB of Wandsworth	73/74/68	KST01
KS9	Battersea Power Station - PS	High	LB of Wandsworth	60/57/50	KST04
KS10	Battersea Power	High	LB of Wandsworth	60/57/50	KST04

Ref	Receptor addresses	Sensitivity	Local authority	Measured average ambient noise level, day/ evening/ night, dBL_{Aeq*}	Noise survey location
	Station - O1				
KS11	Battersea Power Station - RS4	High	LB of Wandsworth	60/57/50	KST04

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

** *33 Nine Elms is assessed as a residential receptor during Site Year 1, but is then demolished. The residences at the New Covent Garden Market Site Entrance are assumed complete and operation at Operation Year 1)*

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 Kirtling Street site have been identified and are as shown in Vol 14 Table 9.5.1.

Vol 14 Table 9.4.2 Noise – residential receptors and assessment categories

Ref	Noise sensitive receptor (No. of dwellings)	Ambient noise level, rounded to nearest $5dBL_{Aeq}$* day/ evening/ night	Assessment category* day/ evening/ night	Impact criterion threshold level*, day, $dBL_{Aeq\ 10hour}$/ evening $dBL_{Aeq\ 1hour}$/ night, $dBL_{Aeq\ 1hour}$
KS1	Shelley House (residential)	75/75/65	C/C/C	75/74/67
KS2	Nine Elms Pier House boats (residential)	65/65/60	B/C/C	70/67/61
KS3	River Lodge	75/75/65	C/C/C	75/74/67

Ref	Noise sensitive receptor (No. of dwellings)	Ambient noise level, rounded to nearest 5dBL_{Aeq}* day/ evening/ night	Assessment category* day/ evening/ night	Impact criterion threshold level*, day, dB$L_{Aeq\ 10hour}$/ evening dB$L_{Aeq\ 1hour}$/ night, dB$L_{Aeq\ 1hour}$
	(residential)			
KS4	Elm Quay (residential)	70/65/60	C/C/C	75/65/62
KS5	Riverlight Block A (residential)	65/65/60	B/C/C	70/67/61
KS6	Riverlight Block B (residential)	65/65/60	B/C/C	70/67/61
KS7	Riverlight Block C (residential)	65/65/60	B/C/C	70/67/61
KS8	33 Nine Elms Lane/New Covent Garden Market Site Entrance (residential)	75/75/70	C/C/C	75/74/68
KS9	Battersea Power Station - PS (residential)	60/55/50	A/B/C	65/60/55
KS10	Battersea Power Station - O1 (residential)	60/55/50	A/B/C	65/60/55
KS11	Battersea Power Station - RS4 (residential)	60/55/50	A/B/C	65/60/55

* *From 'ABC' method – BS5228:2009*[3]

Construction base case

9.4.11 The base case in Site Year 1 of construction taking into account the schemes described in Section 9.3 would include the Battersea Power Station development (blocks PS and O1), and Riverlight (all blocks except A) which fall within the assessment area. Other developments which are within the assessment area are further away from the development and screened by intervening buildings and as such have not been considered here.

9.4.12 The base case in Site Year 3 of construction taking into account the schemes described in Section 9.3 would include the Battersea Power Station development (blocks PS, O1 and RS4), and Riverlight (all). For the purpose of this assessment, only Riverlight blocks A, B and C have been considered as blocks D to F inclusive would be screened from the site by Block C.

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 potential for additional noise from adjacent developments and from the potential 24 hour operation of the Cemex site). The estimated traffic increases for the construction base case in Site Year 1 are such that noise levels would be expected to increase by less than 1dB(A) from those measured in 2011. The assessment based on data from 2011 therefore presents a worst-case assessment.

9.4.14 It is considered that there are no other circumstances at this location that are likely to cause the baseline noise levels at the receptor locations to change significantly between 2011 and Year 1 of construction.

9.4.15 There are no major vibration sources in the area. It is considered that vibration levels are unlikely to change between the present time and the base case.

Operational base case

9.4.16 The base case in Year 1 of operation taking into account the schemes described in Section 9.3 includes the Battersea Power Station blocks PS, O1, RS4, Riverlight (blocks A, B and C), and Embassy Gardens (all blocks) developments which fall within the assessment area and are assumed to be complete and operational during Year 1 of the operational period. Battersea Power Station Blocks RS2 and RS5 would also be complete and have been considered by reference to the other blocks within the development, Riverlight blocks D to F inclusive have not been assessed as these would be screened from any operational plant noise by block A to C in the same development. Nine Elm Parkside has similarly not been assessed as it would be screened by other intervening developments.

9.4.17 The operational base case has been estimated from traffic flow expectations for 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 14 Table 9.5.1 and Vol 14 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 where the impact criterion is exceeded (as marked by an asterisk in Vol 14 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 position across the duration of the construction phase, Vol 14 Appendix G Plates G.6 to G.16 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.

9.5.3 The predicted impacts at each representative receptor location are described below, and Vol 14 Table 9.10.1 shows the assessed significance of effects resulting from all sources of noise and vibration based on the extent of the impacts identified and the particular use of the receptor.

Impacts at residential receptors

9.5.4 The results for residential receptors are shown below in Vol 14 Table 9.5.1.

Vol 14 Table 9.5.1 Noise – impacts at residential receptors (high sensitivity)

Ref/ receptor[a] (No. of noise sensitive properties)	ABC impact criterion threshold level (potential significance for residential), dBL$_{Aeq}$[b]	Range of construction noise levels, dBL$_{Aeq}$[c,d]	Typical[e] monthly construction noise levels, dBL$_{Aeq}$	Magnitude		
				Total duration above criterion for **all** works, months	Worst-case excess above criterion, dBL$_{Aeq}$[f] (*further assessment undertaken for excess above criterion)	Duration of worst-case excess above criterion, months
KS1/ Shelley House (residential)	75	57 – 66 (day)	62	0	-9	0
	74	50 – 63 (eve)	60	0	-11	0
	67	44 – 63 (night)	60	0	-4	0
KS2/ Nine Elms Pier House boats	70	56 – 78 (day)	73	25	+8*	25
	67	48 – 77 (eve)	74	22	+10*	3
	61	46 – 77 (night)	74	22	+16*	3
KS3/ River Lodge	75	57 – 65 (day)	61	0	-10	0
	74	50 – 62 (eve)	59	0	-12	0
	67	44 – 62 (night)	59	0	-5	0
KS4/ Elm Quay	75	41 – 60 (day)	54	0	-15	0
	65	49 – 59 (eve)	56	0	-6	0
	62	25 – 59 (night)	56	0	-3	0
KS5/ Riverlight Block A (Year 3 onwards)	70	66 – 71 (day)	71	19	+1*	19
	67	58 – 66 (eve)	66	0	-1	0
	61	56 – 65 (night)	65	19	+4*	19
KS6/ Riverlight Block B	70	74 – 80 (day)	80	68	+10*	22
	67	67 – 71 (eve)	71	37	+4*	19
	61	67 – 71 (night)	71	37	+10*	19
KS7/ Riverlight Block C	70	62 – 81 (day)	68	24	+11*	1
	67	59 – 63 (eve)	60	0	-4	0
	61	57 – 62 (night)	58	3	+1*	3
KS8/ 33	75	67 – 74 (day)	69	0	-1	0

Ref/ receptor[a] (No. of noise sensitive properties)	ABC impact criterion threshold level (potential significance for residential), dBL$_{Aeq}$[b]	Range of construction noise levels, dBL$_{Aeq}$[c,d]	Typical[e] monthly construction noise levels, dBL$_{Aeq}$	Magnitude		
				Total duration above criterion for all works, months	Worst-case excess above criterion, dBL$_{Aeq}$[f] (*further assessment undertaken for excess above criterion)	Duration of worst-case excess above criterion, months
Nine Elms Lane (Site Year 1 only)	74	54 – 60 (eve)	60	0	-14	0
	68	47 – 59 (night)	59	0	-9	0
KS9/ Battersea Power Station - PS	65	65 -72 (day)	68	68	+7*	1
	60	54 – 63 (eve)	62	22	+3*	3
	55	50 – 63 (night)	61	22	+8*	3
KS10/ Battersea Power Station - O1	65	62 – 65 (day)	65	0	0	0
	60	51 – 59 (eve)	59	0	-1	0
	55	46 – 58 (night)	58	19	+3*	19
KS11/ Battersea Power Station - RS4	65	65 – 68 (day)	68	37	+3*	19
	60	52 – 61 (eve)	61	19	+1*	19
	55	29 – 60 (night)	60	19	+5*	19

[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

Shelley House (KS1)

9.5.5 Shelley House is a large high rise building on the opposite bank of the River Thames which would overlook the majority of the site at a distance of over 200m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.6 The typical daytime noise levels (most frequently occurring monthly level) is 62dBL$_{Aeq}$. The activity expected to cause the worst-case noise level of 66dBL$_{Aeq}$ would be construction of the jetty.

9.5.7 During the evening and night-time, the construction of the main tunnel is expected to cause the worst-case noise levels of 63dBL_{Aeq}.

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

9.5.9 East and west of Shelley house there are other high rise residential buildings, such as Keats House, which is a similar height high rise building. As these properties are further away from the site, these would not to be subject to significant adverse effects either.

Nine Elms Pier Houseboats (KS2)

9.5.10 There would be a number of moorings which would be inside the limits of land to be acquired or used. The site hoarding would screen the residences from the majority of site activities; however activities which occur in the river are likely to be largely unscreened. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.11 The typical daytime noise levels (most frequently occurring monthly level) is 73dBL_{Aeq}. The worst-case noise level would be 78dBL_{Aeq} caused by construction of the jetty. During the evening and night-time, the activity expected to cause the worst-case noise level of 77dBL_{Aeq} would be barge loading during the construction of the main tunnel.

9.5.12 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the day for 25 months and during the evening and night for 22 months.

9.5.13 Given the predicted noise level, the particular receptor sensitivity (due to relatively low sound insulation), the duration that the potential significance criteria is exceeded and the number of affected residents, the effect is considered **significant**.

9.5.14 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.

River Lodge (KS3)

9.5.15 River Lodge is a medium rise building on the opposite bank of the River Thames which would overlook the majority of the site at a distance of over 230m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.16 The typical daytime noise levels (most frequently occurring monthly level) is 61dBL_{Aeq}. The activity expected to cause the worst-case noise level of 65dBL_{Aeq} would be construction of the jetty.

9.5.17 During the evening and night-time, the construction of the main tunnel is expected to cause the worst-case noise levels of 62dBL_{Aeq}.

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

9.5.19 Adjacent to River Lodge are other residential buildings which are further away from the site. As the noise levels at these properties would be lower than at River Lodge, the effect at these properties would also be not significant.

Elm Quay (KS4)

9.5.20 Elm Quay is a medium-rise building east of Heathwall Pumping Station, which would overlook most of the construction activities on the river for the Kirtling Street development at a distance of 80m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.21 The typical daytime noise levels (most frequently occurring monthly level) is 54BL_{Aeq}. The activity expected to cause the worst-case noise level of 60dBL_{Aeq} would be construction of the jetty.

9.5.22 During the evening and night-time, the construction of the main tunnel is expected to cause the worst-case noise levels of 59dBL_{Aeq}.

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

9.5.24 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.

Riverlight Block A (KS5)

9.5.25 Riverlight Block A is a large high-rise building, part of the new Riverlight development immediately to the east of the Kirtling Street development which would overlook the majority of the site once its construction is complete in Year 3 of the development. It lies approximately 20m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.26 The typical daytime noise levels (most frequently occurring monthly level) is 71dBL_{Aeq}. The worst-case noise level would also be 71dBL_{Aeq} caused by the construction of the main tunnel.

9.5.27 During the evening and night-time, the construction of the main tunnel is also expected to cause the worst-case noise levels of 66 and 65dBL_{Aeq} respectively.

9.5.28 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the day for 19 months and during the night for 19 months.

9.5.29 As potentially significant effects have been identified using the ABC criterion during the daytime, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2 Section 9. Secondary glazing or acoustic double glazing has been assumed for these receptors. These assumptions are based on the relatively high ambient noise levels in this area and therefore the noise insulation performance that would be required for a residential development in this setting. Noise transmission to the interior takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.30 The worst-case internal noise level during the day is estimated to be 33dBL_{Aeq} for 19 months with windows closed or approximately 54dBL_{Aeq} if windows were opened on the most exposed façade. There are no other periods for which the potential significance threshold is exceeded. Given that the worst-case internal level could be controlled to below the BS 8233 internal guidance[4] noise level of 40dBL_{Aeq}, with windows closed, and noise levels would not be excessive for speech communication if windows were partially open, this is assessed as **not significant**.

9.5.31 During the evening, the worst-case internal noise levels are below the ABC potential significance threshold and therefore assessed as **not significant**.

9.5.32 The worst-case internal noise level contribution during the night is estimated to be 26dBL_{Aeq} with windows closed or approximately 47dBL_{Aeq} if windows were opened on the most exposed façade. With windows closed, the internal noise level would be well below the BS 8233 design guidance range of 30-35dBL_{Aeq} for bedrooms at night. With windows open, the level would be above the guidance range. Given the exceedance of the relevant guidance noise levels for night-time with windows open, together with the degree of noise increase at night, this is assessed as **significant**.

Riverlight Block B (KS6)

9.5.33 Riverlight Block B is a large high-rise building, part of the new Riverlight development to the immediate east of the Kirtling Street development which would overlook the majority of the site. It lies approximately 20m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.34 The typical daytime noise levels (most frequently occurring monthly level) is 80dBL_{Aeq}. The worst-case noise level would also be 80dBL_{Aeq} caused by the construction of the main tunnel.

9.5.35 During the evening and night-time, the activity expected to cause the worst-case noise level of 71dBL_{Aeq}, would be barge loading during the construction of the main tunnel.

9.5.36 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the day for 68 months and during the evening and night for 37 months.

9.5.37 As potentially significant effects have been identified using the ABC criterion during the daytime, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2 Section 9. Secondary glazing or acoustic double glazing has been assumed for these receptors.

These assumptions are based on the relatively high ambient noise levels in this area and therefore the noise insulation performance that would be required for a residential development in this setting. Noise transmission to the interior takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.38 The worst-case internal noise level during the day is estimated to be 41dBL_{Aeq} for 22 months with windows closed or approximately 62dBL_{Aeq} if windows were opened on the most exposed façade. For the other months during which the potential significance threshold is exceeded, the internal noise levels are estimated to be between 35 and 39dBL_{Aeq} with windows closed. Given the exceedance of the relevant guidance noise levels, together with the degree of noise increase, this is assessed as **significant**.

9.5.39 The worst-case internal noise level during the evening is estimated to be 32dBL_{Aeq} for 19 months with windows closed or approximately 53dBL_{Aeq} if windows were opened on the most exposed façade. Given that the worst-case internal level could be controlled to below the BS 8233 internal guidance noise level of 40dBL_{Aeq}, with windows closed, and noise levels would not be excessive for speech communication if windows were partially open, this is assessed as **not significant**.

9.5.40 The worst-case internal noise level contribution during the night is estimated to be 32dBL_{Aeq} with windows closed or approximately 53dBL_{Aeq} if windows were opened on the most exposed façade. With windows closed, the internal noise level would be within the BS 8233 design guidance range of 30-35dBL_{Aeq} for bedrooms at night. With windows open, the level would be above the guidance range. Given the exceedance of the relevant guidance noise levels for night-time with windows open, together with the degree of noise increase at night, this is assessed as **significant**.

Riverlight Block C (KS7)

9.5.41 Riverlight Block C is a large high rise building, part of the new Riverlight development to the immediate east of the Kirtling Street development. The southern part of the building would be partly screened from noise from the development by the presence of Block B, which is to be of equivalent height. The northern half of the building would overlook the Kirtling Street site during the first two years of the development, during which time Riverlight Block A would be constructed between the northern part of the western façade of block C and the Kirtling street development.

9.5.42 After Year 3 of the development, the majority of Block C would be screened by Block A, however residences in the middle of the development would have a direct view of a small part of the site, and it is these which have been assessed. Block C lies approximately 40m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.43 The typical daytime noise levels (most frequently occurring monthly level) is 68dBL_{Aeq}. The activity expected to cause the worst-case noise level of 81dBL_{Aeq} for one month would be site establishment works.

9.5.44 During the evening and night-time, the construction of the main tunnel is expected to cause the worst-case noise levels of 63 and 62dBL_{Aeq} respectively.

9.5.45 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the day for 24 months and during the night for 3 months.

9.5.46 As potentially significant effects have been identified using the ABC criterion during the daytime, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2 Section 9. Secondary glazing or acoustic double glazing has been assumed for these receptors. These assumptions are based on the relatively high ambient noise levels in this area and therefore the noise insulation performance that would be required for a residential development in this setting. Noise transmission to the interior takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.47 The worst-case internal noise level during the day is estimated to be 41dBL_{Aeq} for 1 month with windows closed or approximately 62dBL_{Aeq} if windows were opened on the most exposed façade. For the other months during which the potential significance threshold is exceeded, the internal noise levels are estimated to be between 32 and 39dBL_{Aeq} with windows closed. Given the exceedance of the relevant guidance noise levels, together with the degree of noise increase, this is assessed as **significant**.

9.5.48 During the evening, the worst-case internal noise levels are below the ABC potential significance threshold and therefore assessed as **not significant**.

The worst-case internal noise level contribution during the night is estimated to be 23dBL_{Aeq} with windows closed or approximately 44dBL_{Aeq} if windows were opened on the most exposed façade. With windows closed, the internal noise level would be well below the BS 8233 design guidance range of 30-35dBL_{Aeq} for bedrooms at night. With windows open, the level would be above the guidance range. Although the construction noise only exceeds the ambient noise level by 1dB, the increase in noise further above the relevant guidance noise levels, is assessed as **significant**.

9.5.49 East of block C there is the rest of the Riverlight development (blocks D-F) which would be screened by blocks A-C. Also screened from the site is the Embassy Gardens development. As these properties are further away from the site, the impacts on these properties would be considerably lower, and it is not considered that these would be subject to significant adverse effects.

33 Nine Elms Lane (KS8)

9.5.50 33 Nine Elms Lane is a four storey tall residential building which would overlook the majority of the site at a distance of 15m from the southern edge of the site boundary. The building is present during Site Year 1 only, after which it is demolished in order to construct the New Covent Garden Site Entrance. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1**.**

9.5.51 The typical daytime noise levels (most frequently occurring monthly level) is 69dBL_{Aeq}., The activity expected to cause the worst-case noise level of 74dBL_{Aeq} would be the demolition on the site.

9.5.52 During the evening and night-time, the construction of the main tunnel is expected to cause the worst-case noise levels of 60 and 59dBL_{Aeq} respectively (below ambient noise levels).

9.5.53 The worst-case construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor at any time during the day, evening or night. The effect is therefore **not significant**.

9.5.54 Further west on Battersea Park Road are other residences at Veridan Apartments and Thessaly House. These are further away from the site and the noise impact at these properties would not be higher than that assessed at 33 Nine Elms Lane. It is not considered that these would be subject to significant adverse effects.

Battersea Power Station - PS (KS9)

9.5.55 Battersea Power Station itself forms block PS, and is assumed to be a high rise residential development which would overlook the majority of the site at a distance of over 80m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.56 The typical daytime noise levels (most frequently occurring monthly level) is 68dBL_{Aeq}. The activity expected to cause the worst-case noise level of 72dBL_{Aeq} would be construction of the jetty.

9.5.57 During the evening and night-time, the activity expected to cause the worst-case noise level of 63dB$L_{Aeq,}$ would be barge loading during the construction of the main tunnel.

9.5.58 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the day for 68 months and during the evening and night for 22 months.

9.5.59 As potentially significant effects have been identified using the ABC criterion during the daytime, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2 Section 9. Secondary glazing or acoustic double glazing has been assumed for these receptors. These assumptions are based on the relatively high ambient noise levels in this area and therefore the noise insulation performance that would be required for a residential development in this setting. Noise transmission to the interior takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.60 The worst-case internal noise level during the day is estimated to be 33dBL_{Aeq} for 1 month with windows closed or approximately 54dBL_{Aeq} if windows were opened on the most exposed façade. For the other months during which the potential significance threshold is exceeded, the internal noise levels are estimated to be between 27 and 32dBL_{Aeq} with windows closed. Given that the worst-case internal level could be controlled to below the BS 8233 internal guidance noise level of 40dBL_{Aeq}, with windows closed, and noise levels would not be excessive for speech communication if windows were partially open, this is assessed as **not significant**.

9.5.61 The worst-case internal noise level during the evening is estimated to be 24dBL_{Aeq} for 3 months with windows closed or approximately 45dBL_{Aeq} if windows were opened on the most exposed façade. Given that the worst-case internal level could be controlled to below the BS 8233 internal guidance noise level of 40dBL_{Aeq}, with windows closed, and noise levels would not be excessive for speech communication if windows were partially open, this is assessed as **not significant**.

9.5.62 The worst-case internal noise level contribution during the night is estimated to be 24dBL_{Aeq} with windows closed or approximately 45dBL_{Aeq} if windows were opened on the most exposed façade. With windows closed, the internal noise level would be well below the BS 8233 design guidance range of 30-35dBL_{Aeq} for bedrooms at night. With windows open, the level would be above the guidance range. Given the exceedance of the relevant guidance noise levels for night-time with windows open, together with the degree of noise increase at night, this is assessed as **significant**.

9.5.63 To the west of the Power Station building, block RS-1 would also be complete during the construction of the development. However as the Power Station building would screen this block from the works, it is not considered that it would be subject to significant adverse effects.

Battersea Power Station - O1 (KS10)

9.5.64 Block O1 of Battersea Power Station development is a large high rise building with the potential to overlook the majority of the site at a distance of 130m from the site boundary. The lower floors would be screened entirely from the site by block RS4, however as the relative heights of these buildings are no known it has been assumed that the upper floors would have a direct view of the site. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.65 The typical daytime noise levels (most frequently occurring monthly level) is 65dBL_{Aeq}. The worst-case noise level would also be 65dBL_{Aeq} caused by the construction of the jetty. During the evening and night-time, the activity expected to cause the worst-case noise level of 59 and 58dBL_{Aeq} respectively would be barge loading during the construction of the main tunnel.

9.5.66 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the night for 19 months.

9.5.67 As potentially significant effects have been identified using the ABC criterion during the night time, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows open and closed. The approach to estimating internal noise levels is described in the methodology in Vol 2 Section 9. Secondary glazing or acoustic double glazing has been assumed for these receptors. These assumptions are based on the relatively high ambient noise levels in this area and therefore the noise insulation performance that would be required for a residential development in this setting. Noise transmission to the interior takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.68 During the day and evening, the worst-case internal noise levels are below the ABC potential significance threshold and therefore assessed as **not significant**.

9.5.69 The worst-case internal noise level contribution during the night is estimated to be 19dBL_{Aeq} with windows closed or approximately 40dBL_{Aeq} if windows were opened on the most exposed façade. With windows closed, the internal noise level would be well below the BS 8233 design guidance range of 30-35dBL_{Aeq} for bedrooms at night. With windows open, the level would be above the guidance range. Given the exceedance of the relevant guidance noise levels for night-time with windows open, together with the degree of noise increase at night, this is assessed as **significant**.

Battersea Power Station - RS4 (KS11)

9.5.70 Block RS4 of Battersea Power station development is a large high rise building with the potential to overlook the majority of the site at a distance of 80m from the site boundary. The predicted noise levels at these dwellings due to construction activities are shown in Vol 14 Table 9.5.1.

9.5.71 The typical daytime noise levels (most frequently occurring monthly level) is 68dBL_{Aeq}. The worst-case noise level is also 68dBL_{Aeq} caused by the construction of the jetty. During the evening and night-time, the activity expected to cause the worst-case noise level of 61 and 60dBL_{Aeq} respectively, would be barge loading during the construction of the main tunnel.

9.5.72 The construction noise levels are estimated to exceed the potential significance criteria for a residential receptor during the day for 37 months and during the evening and night for 19 months.

9.5.73 As potentially significant effects have been identified using the ABC criterion during the daytime, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Vol 2 Section 9. Secondary glazing or acoustic double glazing has been assumed for these receptors. These assumptions are based on the relatively high ambient noise levels in this area and therefore the noise insulation performance that would be required for a residential development in this setting. Noise transmission to the interior takes into account the glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.74 The worst-case internal noise level during the day is estimated to be 29dBL_{Aeq} for 19 months with windows closed or approximately 50dBL_{Aeq} if windows were opened on the most exposed façade. For the other months during which the potential significance threshold is exceeded, the internal noise levels are estimated to be between 26 and 27dBL_{Aeq} with windows closed. Given that the worst-case internal level could be controlled to below the BS 8233 internal guidance noise level of 40dBL_{Aeq}, with windows closed, and noise levels would not be excessive for speech communication if windows were partially open, this is assessed as **not significant**.

9.5.75 The worst-case internal noise level during the evening is estimated to be 22dBL_{Aeq} for 19 months with windows closed or approximately 43dBL_{Aeq} if windows were opened on the most exposed façade. Given that the worst-case internal level could be controlled to below the BS 8233 internal guidance noise level of 40dBL_{Aeq}, with windows closed, and noise levels would not be excessive for speech communication if windows were partially open, this is assessed as **not significant**.

9.5.76 The worst-case internal noise level contribution during the night is estimated to be 21dBL_{Aeq} with windows closed or approximately 42dBL_{Aeq} if windows were opened on the most exposed façade. With windows closed, the internal noise level would be well below the BS 8233 design guidance range of 30-35dBL_{Aeq} for bedrooms at night. With windows open, the level would be above the guidance range. Given the exceedance of the relevant guidance noise levels for night-time with windows open, together with the degree of noise increase at night, this is assessed as **significant**.

9.5.77 There are no other residential properties in the vicinity close enough to be subject to significant adverse effects which are not already considered in this assessment.

Road-based construction traffic

9.5.78 The location of the site adjacent to Kirtling Street provides direct access to the major road network through London. The construction programme would result in varying traffic generation over a period of five years. During the peak construction period the traffic generation is forecast to average 96 heavy vehicles (HGVs) (equivalent to 192 HGV movements) per day.

9.5.79 The major road links adjacent to and leading from the site are Battersea Park Road and Nine Elms Lane. Vehicles are also likely to use Cringle Street and Kirtling Street to access the site, which are local roads.

9.5.80 A flow change of about 25% is required to cause a change in noise level of 1dB and by 100% to cause a change of 3dB, which is considered to be the minimum change perceptible to the human ear. Additionally, a change in the proportion of heavy goods vehicles (HGV) of 5% is also considered to cause an approximate change in noise level of 1dB.

9.5.81 The traffic modelling shows that the 18hr flow on Battersea Park Road, which is adjacent to the site is currently over 26,000 vehicles per day (vpd), with average speeds of 30 mph (48 kph) and 8.8 % heavy vehicles (HGVs). The total number of HGVs is therefore currently over 2,300 per day.

9.5.82 The section of Battersea Park Road which is to the South West of the site currently has the highest 18hr flow, with over 28,000 vpd and 9.7% HGVs. The 18hr flows on the other major roads are very similar. However, Nine Elms Lane has a significantly higher HGV percentage (20%) compared to Battersea Park Road. With regards to the local roads, the flows are approximately 1,000 vpd with high percentages of HGVs (20% and 25%).

9.5.83 The modelling of construction traffic on these links shows that if it is assumed that construction traffic from both Nine Elms Lane and Battersea Park Road use only Kirtling Street or only Cringle Street to access the site, the highest percentage increase in total flow due to construction HGVs would occur on one of these links. The current flow on both links is approximately 1,000 vpd. If construction traffic from Nine Elms Lane and Battersea Park Road use only Kirtling Street or only Cringle Street to access the site, the average daily number of construction HGVs on either link during the peak month of construction is 192. This represents a percentage increase in flow of just below 25% and 22% on Kirtling Street and Cringle Street respectively. Flow changes on other roads are less than 1%.

9.5.84 Using these assumptions, the modelling of the construction traffic on these links shows that the highest increase in proportion of HGVs would occur on Kirtling Street. The average daily number of construction HGVs on this link during the peak month of construction is 192, which represents a decrease in proportion of HGV of 3%. On Cringle Street, the reduction in HGV proportion is 10%. On other links the change in HGV proportion is less than 1%.

9.5.85 These changes in flows do not exceed the 1dB change criteria during the peak construction period and therefore the change in noise level due to construction traffic is considered to be **not significant** to receptors on Cringle Street (Battersea Power Station) and Kirtling Street (Riverlight).

River-based construction traffic

9.5.86 The use of river barges for the transport of materials to and from the site could result in noise impacts at nearby receptors.

9.5.87 The movement of these barges would be at appropriate stages in the tide. In between times the moored barges would be unloaded or loaded. Noise measurements for such activity have been reported in other studies[5]. The engine noise from movement of the barges on the River Thames is limited to 75dB(A) at 25m[6].

9.5.88 The maximum use of tugs is planned at twice a day with the tide. Each movement (delivery and removal) would be 25 minutes in duration, totalling 50 minutes for each tug for two periods per day. The maximum river-based activity would result in 20 minutes of movement over two periods. The barges would not operate concurrently and therefore noise levels generated would be the same.

9.5.89 The operation, loading and removal of the river barges which takes place within the site boundary has been considered in the construction noise assessment in paras. 9.5.1 to 9.5.77.

9.5.90 The operation of the tugs on the river outside of the site boundary has been assessed in relation to the nearest residential receptors, Nine Elms Pier to the east and Battersea Power Station block PS to the west.

9.5.91 At Nine Elms Pier the tugs would operate at a minimum distance of 30m. At this distance the predicted night time (23:00-07:00) noise from this activity would be 60dBL$_{Aeq,}$ at the dwelling. The survey indicates the noise level at this location is 62dBL$_{Aeq}$ (see Vol 14 Appendix G Table G.10) over the same period, which is greater than the tug noise and therefore the noise from river based construction traffic is considered to be **not significant**.

9.5.92 At Battersea Power Station block PS the tugs would operate at a minimum distance of 60m. At this distance the predicted night time (23:00-07:00) noise from this activity would be 53dBL$_{Aeq}$ at the dwelling. The survey indicates the noise level at this location is 55dBL$_{Aeq}$ as averaged over the same period (see Vol 14 Appendix G Table G.10), which is greater than the tug noise and therefore the noise from river based construction traffic is considered to be **not significant**.

Vibration

9.5.93 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.

9.5.94 The impact 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 14 Table 9.5.2.

9.5.95 All the activities at the development which are likely to create high vibration levels occur during the daytime only, ie, piling and vibratory compaction.

Vol 14 Table 9.5.2 Vibration – impact and magnitude of human response to vibration impacts

Ref	Receptor	Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)*	Value/ sensitivity	Magnitude**
KS1	Shelley House	0.1	High	Below Low probability of adverse

Ref	Receptor	Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)*	Value/ sensitivity	Magnitude**
				comment - No impact
KS2	Nine Elms Pier House boats	0.3	High	Low probability of adverse comment - No impact
KS3	River Lodge	0.1	High	Below Low probability of adverse comment - No impact
KS4	Elm Quay	0.1	High	Below Low probability of adverse comment - No impact
KS5	Riverlight Block A	0.2	High	Low probability of adverse comment - No impact
KS6	Riverlight Block B	0.2	High	Low probability of adverse comment - No impact
KS7	Riverlight Block C	0.2	High	Low probability of adverse comment - No impact
KS8	33 Nine Elms Lane	0.2	High	Low probability of adverse comment - No impact
KS9	Battersea Power Station - PS	0.1	High	Below Low probability of adverse comment - No impact
KS10	Battersea Power Station - O1	0.1	High	Below Low probability of

Ref	Receptor	Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)*	Value/ sensitivity	Magnitude**
				adverse comment - No impact
KS11	Battersea Power Station - RS4	0.1	High	Below Low probability of adverse comment - No impact

**Most affected floor*

*** Predicted vibration levels assume groundborne transmission. For boats moored in the river it is expected that vibration transmission would be reduced and the vibration levels would be lower than those estimated.*

9.5.96 The predicted eVDV levels at all of the receptor locations fall within or below the 'Low probability of adverse comment' band, therefore effects on human response to vibration are **not significant**.. These predicted levels are based upon the highest anticipated exposures during the most intense vibration activities within the site.

9.5.97 The assessment of potential construction vibration effects at adjacent buildings / structures has been assessed using the predicted Peak Particle Velocity (PPV), according to the criteria given in Vol 2 Section 9. The results of the assessment of construction vibration are presented in Vol 14 Table 9.5.3.

Vol 14 Table 9.5.3 Vibration – building vibration impacts and their magnitudes

Ref	Receptor	Impact (highest predicted PPV across all activities, mm/s)*	Value/ sensitivity	Magnitude**
KS1	Shelley House	0.1	High	Below threshold of potential cosmetic damage - No impact
KS2	Nine Elms Pier House boats	0.5	High	Below threshold of potential cosmetic damage - No impact

Ref	Receptor	Impact (highest predicted PPV across all activities, mm/s)*	Value/ sensitivity	Magnitude**
KS3	River Lodge	0.1	High	Below threshold of potential cosmetic damage - No impact
KS4	Elm Quay	0.1	High	Below threshold of potential cosmetic damage - No impact
KS5	Riverlight Block A	0.8	High	Below threshold of potential cosmetic damage - No impact
KS6	Riverlight Block B	0.8	High	Below threshold of potential cosmetic damage - No impact
KS7	Riverlight Block C	0.2	High	Below threshold of potential cosmetic damage - No impact
KS8	33 Nine Elms Lane	0.6	High	Below threshold of potential cosmetic damage - No impact
KS9	Battersea Power Station - PS	0.1	High	Below threshold of potential cosmetic damage - No impact
KS10	Battersea Power Station - O1	0.1	High	Below threshold of potential cosmetic damage - No impact

Ref	Receptor	Impact (highest predicted PPV across all activities, mm/s)*	Value/ sensitivity	Magnitude**
KS11	Battersea Power Station - RS4	0.1	High	Below threshold of potential cosmetic damage - No impact

**Most affected floor*

*** Predicted vibration levels assume groundborne transmission. For boats moored in the river it is expected that vibration transmission would be reduced and the vibration levels would be lower than those estimated.*

9.5.98 The vibration levels reported here are well below the levels likely to cause cosmetic building damage according to the criteria described in Vol 2 Section 9.

9.5.99 Vibration effects are assessed as **not significant**.

Sensitivity test for programme delay

9.5.100 In considering the effects of a delay to the Thames Tideway Tunnel project of approximately one year, Block A of the Riverlight development has been considered as under construction during Site Year 1 (instead of Site Years 1 and 2 above) and as a receptor from Site Year 2 (instead of from Site Year 3 above). 33 Nine Elms Lane would no longer be a receptoras it would be demolished to make way for the New Covent Garden Market Entrance Site, which has been considered as a receptor during the final Site Year. Also requiring consideration is Battersea Power Station block RS-2, parts of which would be complete in the final year of construction.

9.5.101 It is considered that 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 Riverlight development, or the existing receptors, however there is a possibility of **significant** noise effect to the New Covent Garden Market Entrance Site and Battersea Power Station block RS-2 receptors.

9.6 Operational effects assessment

Impacts from potential noise and vibration sources

9.6.1 The following section describes the potential noise and vibration effects from various sources identified for assessment.

Noise from operational plant at above ground structures

9.6.2 A passive ventilation system is to be installed at Kirtling Street and therefore there is no requirement to install active ventilation equipment at this location. Plant which has been included in this section is as described in para 9.2.10. The prediction method and assumptions are described in

Vol 2 Section 9. As mentioned in para 9.3.20, it has been assumed that the reconfigured Cemex site would be subject to existing controls on noise and vibration which are associated with its original planning application. Provided these controls are met, it is considered that there would be no significant effect from the operation of the Cemex site.

9.6.3 The appropriate emission limits are shown below in Vol 14 Table 9.6.1, based on local authority requirements to ensure that no adverse effects would occur. As there is no active ventilation plant for the drop shaft to generate noise at this site, these limits would only apply to any minor plant equipment. If cooling fans for the kiosks are required, this equipment would be controlled to meet the criteria in Vol 14 Table 9.6.1. However, it should be noted that any such equipment would be expected to have a relatively low noise emission (approximately 45dB(A) at 3m).

9.6.4 Vol 14 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 14 Table 9.6.1 Noise – operational airborne noise impacts

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensitivity	Magnitude
KS1	Shelley House	$48dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $38dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
KS2	Nine Elms Pier House boats	$50dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $40dBL_{Ar,Tr}$	Medium	Plant noise level below local authority limit*,– no adverse impact
KS3	River Lodge	$48dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $38dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
KS4	Elm Quay	$44dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor	High	Plant noise level below local authority

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensitivity	Magnitude
			less than $34dBL_{Ar,Tr}$		limit*,– no adverse impact
KS5	Riverlight Block A	$50dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $40dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
KS6	Riverlight Block B	$50dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $40dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
KS7	Riverlight Block C	$50dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $40dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
KS8	New Covent Garden Market Site Entrance (operational only)	$49dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $39dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
KS9	Battersea Power Station - PS**	$50dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $40dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
KS 10	Battersea Power Station - O1	$50dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than	High	Plant noise level below local authority limit*,– no

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensitivity	Magnitude
			$40dBL_{Ar,Tr}$		adverse impact
KS 11	Battersea Power Station - RS4	$50dBL_{A90,}$ 15 minutes	Plant noise emission rating level at receptor less than $40dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact

** Limit referred to is that identified for the Local Authority in which the receptor is located (see para.9.3.20).*
***Also applicable to Battersea Power Station blocks RS-5 and RS-2*

9.6.5 The results given above in Vol 14 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.

Operational maintenance

9.6.6 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.

9.6.7 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.

9.6.8 As no impacts have been identified from the operation of the site, effects are considered to be **not significant**.

Noise from operational traffic

9.6.9 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.

9.6.10 As a proportion of the existing traffic on the road network these vehicles would not contribute to the traffic noise level and the noise effects of these movements are assessed as **not significant**.

Sensitivity test for programme delay

9.6.11 For the assessment of noise and vibration effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors as the operational effects of the Thames Tideway Tunnel project are considered to be not significant. Based on the site development schedule (see Vol 14 Appendix N), there would be no new receptors, within the assessment area, requiring assessment as a result of a one year delay.

9.7 Cumulative effects assessment

Construction effects

9.7.1 Of the projects described in Section 9.3, the ongoing construction of Battersea Power Station (blocks RS-2 and RS-5) development, Riverlight block A, the Nine Elms Parkside development and Embassy Gardens are considered likely to give rise to cumulative construction effects on noise and vibration.

9.7.2 It is likely that the Riverlight development (blocks B and C), the Battersea Power Station development (blocks PS, O1 and RS4), house boats on Nine Elms Pier and 33 Nine Elms Lane (Year 1 only) would be subject to additional noise, particularly during the daytime from the large amount of other construction work in the area. The majority of noise from construction work additional to the Kirtling Street development would be from the completion of other buildings within the same development:

a. Nine Elms Pier would be subject to additional noise from the construction of Riverlight block A

b. Elm Quay would be subject to noise from the development at Heathwall Pumping Station and Embassy Gardens

c. Riverlight blocks B and C would be subject to additional noise from the construction of block A and the Nine Elms Parkside site

d. 33 Nine Elms Lane would be subject to construction noise from the Nine Elms Parkside site

e. Battersea Power Station Blocks PS, O1 and RS4 would be subject to construction noise from the construction of block RS5 and RS2

9.7.3 Of the above identified properties, only 33 Nine Elms Lane and Elm Quay have not had a significant residual effect identified as a result of the Kirtling Street development. The likelihood of a cumulative significant effect at 33 Nine Elms Lane is high owing to a large amount of on-going construction in the area, particularly during the daytime and particularly if there are significant effects on this property from the Nine Elms Parkside development.

9.7.4 Elm Quay does not have a significant effect identified as a result of works at the Kirtling Street site. However as a significant effect is predicted for this receptor as a result of the Heathwall Pumping station site (see Vol 15 Section 9.5), and the construction of Embassy Gardens could also lead to significant effects. As such, a cumulative effect is identified for this receptor.

9.7.5 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately one year, more of the Riverlight, Battersea Power Station, Nine Elms Parkside and Embassy Gardens developments would be built and occupied which would lead to a corresponding reduced level of cumulative activity. Cumulative effects would therefore be no greater than described above.

Operational effects

9.7.6 None of the projects described in Section 9.3, are considered relevant to the operational cumulative assessment at the Kirtling Street site as due to their use, they are not expected to generate significant noise or vibration levels during their operation. As such, no cumulative operational noise or vibration effects are identified. This would also be the case if the programme for the Thames Tideway Tunnel project was delayed by approximately one year.

9.8 Mitigation and compensation

Construction

9.8.1 The above assessment has concluded that there are significant adverse construction noise effects at the Nine Elms Pier houseboats, and the Riverlight and Battersea Power Station developments. However, no further practicable noise mitigation can be adopted on site above those methods identified in the *CoCP*.

9.8.2 A *noise insulation and temporary re-housing policy* has been established (see Schedule 2 of the *Statement of Reasons*, which accompanies this application). The policy seeks to offset the potential adverse noise effects arising from construction and would be available to those residents where predicted or measured construction noise levels exceed trigger levels published in the policy. As there is no guarantee that the noise control measures would be accepted by the affected party, the two scenarios (with and without implementation of the policy) are presented in the residual effects section below.

9.8.3 The following residential properties may be eligible for noise insulation as described in the policy. This is a commonly used measure to control construction noise ingress to residential properties.

a. Riverlight Blocks A, B and C

b. Battersea Power Station Blocks PS, O1 and RS4

9.8.4 The effect of noise insulation on noise exposure inside the properties has been assessed in Section 9.9.

9.8.5 Although the noise insulation eligibility thresholds are exceeded for the houseboats at Nine Elms Pier, the standard noise insulation measures available would not be effective or appropriate for houseboats. The residents may be eligible for temporary re-housing (under special cases provisions) through the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* (see Schedule 2 of the *Statement of Reasons*, which accompanies this application).

Sensitivity test for programme delay

9.8.6 The assessment has also identified that there is the possibility of significant adverse noise effects at New Covent Garden Market Entrance Site and Battersea Power Station block RS-2 if the Thames Tideway Tunnel project was delayed by approximately one year. The noise levels predicted at these properties are rated as significant using the extended ABC and qualitative method (as discussed in Section 9.5 and Volume 2) however the levels would not exceed the thresholds given in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* and as such these properties would not be eligible for noise insulation under this policy.

9.8.7 The residents 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.

Operation

9.8.8 The above assessment has concluded that there are not likely to be any significant adverse effects during the operational phase that would require mitigation.

Monitoring

9.8.9 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

Riverlight (KS5-7) and Battersea Power Station (KS9-11) developments

9.9.1 The construction noise assessment set out above in Section 9.5 has identified significant effects at Riverlight Blocks A, B and C and Battersea Power Station Blocks PS, O1 and RS4

9.9.2 The significant noise effects could be addressed by noise insulation as set out in the noise insulation and temporary re-housing policy (see para. 9.8.2). It must be recognised, however, that the affected residents may not wish to take up the offer of noise insulation and thus the residual construction noise effects remains as presented in Section 9.5.

9.9.3 If a noise insulation package as described in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* were installed, the internal daytime noise levels at the affected blocks within the Riverlight and Battersea Power Station developments are estimated to reduce during the short period of worst-case noise levels to below the guidance criteria for living rooms. At night, noise levels are also estimated to be below internal night-time guidance levels for bedrooms. The inclusion of mechanical ventilation as part of the insulation package would allow windows to be closed at night-time to realise the full benefit of the noise insulated glazing. With the inclusion of a noise insulation package the construction noise effects would be rated as **not significant**.

Nine Elms Pier Houseboats (KS2)

9.9.4 As discussed at para. 9.8.5 the noise levels at the Nine Elms Pier Houseboats do exceed the thresholds for noise insulation provided (under special cases provisions) by the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* however the standard noise insulation measures available would not be effective or appropriate for houseboats. These properties may, however, be eligible for temporary re-housing under the *Thames Tideway Tunnel noise insulation and temporary re-housing policy.* It must be recognised, however, that the residents may not wish to take up the offer of temporary re-housing and thus the residual construction noise effects remains as presented in Section 9.5. The effects of temporary re-housing on the residents of the houseboats have been assessed in Vol 14 Section 10 Socio-economics.

Operational effects

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

9.10 Assessment summary

Vol 14 Table 9.10.1 Noise – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Surface construction noise				
KS1 - Shelley House	Noise	Not significant	None	Not significant
KS2 - Nine Elms Pier Houseboats	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for temporary re-housing. The effects of temporary re-housing on the residents of the houseboats have been assessed in Vol 14 Section 10 Socio-economics. See para. 9.9.4
KS3 - River Lodge	Noise	Not significant	None	Not significant
KS4 - Elm Quay	Noise	Not significant	None	Not significant
KS5 - Riverlight Block A	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para. 9.9.3
KS6 - Riverlight Block B	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para. 9.9.3
KS7 - Riverlight Block C	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
				to not significant. See para. 9.9.3
KS8 - 33 Nine Elms Lane/New Covent Garden Market Site Entrance	Noise	Not significant	None	Not significant
KS9 - Battersea Power Station - PS	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para. 9.9.3
KS10 - Battersea Power Station - O1	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para. 9.9.3
KS11 - Battersea Power Station - RS4	Noise	Significant	No further mitigation on site practicable	Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para. 9.9.3
Road-based construction traffic				
Residential and non-residential properties adjacent to the proposed vehicle route	Noise	Not significant	None	Not significant
River-based construction traffic				
KS2 - Nine Elms Pier Houseboats	Noise	Not significant	None	Not significant
KS9 - Battersea Power Station - PS	Noise	Not significant	None	Not significant

Vol 14 Table 9.10.2 Vibration – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
KS1 - Shelley House	Vibration	Not significant	None	Not significant
KS2 - Nine Elms Pier Houseboats	Vibration	Not significant	None	Not significant
KS3 - River Lodge	Vibration	Not significant	None	Not significant
KS4 - Elm Quay	Vibration	Not significant	None	Not significant
KS5 - Riverlight Block A	Vibration	Not significant	None	Not significant
KS6 - Riverlight Block B	Vibration	Not significant	None	Not significant
KS7 - Riverlight Block C	Vibration	Not significant	None	Not significant
KS8 - 33 Nine Elms Lane/New Covent Garden Market Site Entrance	Vibration	Not significant	None	Not significant
KS9 - Battersea Power Station - PS	Vibration	Not significant	None	Not significant
KS10 - Battersea Power Station - O	Vibration	Not significant	None	Not significant
KS11 - Battersea Power Station - RS4	Vibration	Not significant	None	Not significant

Vol 14 Table 9.10.3 Noise – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
KS1 - Shelley House	Noise	Not significant	None	Not significant
KS2 - Nine Elms Pier Houseboats	Noise	Not significant	None	Not significant
KS3 - River Lodge	Noise	Not significant	None	Not significant
KS4 - Elm Quay	Noise	Not significant	None	Not significant
KS5 - Riverlight Block A	Noise	Not significant	None	Not significant
KS6 - Riverlight Block B	Noise	Not significant	None	Not significant
KS7 - Riverlight Block C	Noise	Not significant	None	Not significant
KS8 - 33 Nine Elms Lane/New Covent Garden Market Site Entrance	Noise	Not significant	None	Not significant
KS9 - Battersea Power Station - PS	Noise	Not significant	None	Not significant
KS10 - Battersea Power Station - O	Noise	Not significant	None	Not significant
KS11 - Battersea Power Station - RS4	Noise	Not significant	None	Not significant

Vol 14 Table 9.10.4 Vibration – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
KS1 - Shelley House	Vibration	Not significant	None	Not significant
KS2 - Nine Elms Pier Houseboats	Vibration	Not significant	None	Not significant
KS3 - River Lodge	Vibration	Not significant	None	Not significant
KS4 - Elm Quay	Vibration	Not significant	None	Not significant
KS5 - Riverlight Block A	Vibration	Not significant	None	Not significant
KS6 - Riverlight Block B	Vibration	Not significant	None	Not significant
KS7 - Riverlight Block C	Vibration	Not significant	None	Not significant
KS8 - 33 Nine Elms Lane/New Covent Garden Market Site Entrance	Vibration	Not significant	None	Not significant
KS9 - Battersea Power Station - PS	Vibration	Not significant	None	Not significant
KS10 - Battersea Power Station - O	Vibration	Not significant	None	Not significant
KS11 - Battersea Power Station - RS4	Vibration	Not significant	None	Not significant

References

[1] Defra. National Policy Statement for Waste Water (2012) Available at: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf. 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] British Standards Institution, *BS 8233 Code of Practice for Sound insulation and noise reduction for buildings* (1999)

[5] Peter Brett Associates on behalf of Lafarge Cement UK, Northfleet *Works Bulk Aggregates Import Terminal. Document 2h: Environmental Statement* Volume 3 Appendices: Appendix D.3

[6] Port of London Authority, *Draft Thames Freight Operations Vessel Standards*

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 10: Socio-economics

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

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling 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 Kirtling Street site. At this site effects during construction are considered on businesses within the limits of land to be acquired or used (LLAU), on users of the Thames Path National Trail and Right of Way (Thames Path) and on nearby residents.

10.1.2 As set out in Vol 14 Section 9 Noise and vibration, the noise insulation eligibility thresholds would be exceeded for the houseboats at Nine Elms Pier. However, the standard noise insulation measures available would not be effective or appropriate for houseboats. Accordingly, residents of the houseboats at Nine Elms Pier may be eligible for temporary re-housing during certain periods of the construction phase. For this reason, this assessment considers the effect of temporary re-housing on those residents.

10.1.3 Operational effects for socio-economics for this site have not been assessed for the following reasons:

a. There would be no designated employment land in this locality which would be affected by the project.

b. With regard to effects on house boats, there would be no disruption of access to or from the house boats, or any loss of mooring opportunities for house boats in the operational phase.

10.1.4 Therefore no significant operational effects are considered likely and for this reason only information relating to construction is presented in the assessment of effects on socio-economics.

10.1.5 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.

10.1.6 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.

10.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling Street Figures).

10.1.8 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 A river jetty would be constructed out in to the river foreshore, and would extend beyond the Nine Elms Pier residential mooring complex to the east and the concrete batching works jetty to the west.

10.2.3 The demolition of above ground structures would include plant and buildings associated with the Cemex site concrete batching works, industrial warehouses and ancillary offices, and an existing terraced 11-unit office complex (Brooks Court) that mostly fronts on to Kirtling Street.

10.2.4 The Cemex site would be reconfigured for the duration of the construction works, and Cemex's operations would be accommodated temporarily within a smaller site to the west of the Thames Tideway Tunnel project construction site[i]. Cemex would retain direct access to both Kirtling Street and their existing river jetty. See separate volume of figures – Section 1 for the Demolition and site clearance plan for this site.

10.2.5 The Thames Path National Trail and Right of Way (Thames Path) would be temporarily diverted for the duration of the construction period, from the point at which it meets Kirtling Street from the riverside, via the eastern arm of Kirtling Street onto Nine Elms Lane.

10.2.6 The northern and western sections of Kirtling Street (north of Cringle Street) would be closed and included as part of the proposed construction site.

10.2.7 Works at the site are expected to last approximately six years. See Section 3.3 of this volume for further details of the construction working hours.

10.2.8 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

10.2.9 Construction is expected to require a maximum workforce of approximately 235 workers at any one time, ie, during the daytime shift. The number and type of workers is shown in Vol 14 Table 10.2.1.

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[i] Despite working within a reduced footprint it is understood that the company would be able to maintain or look to increase its operational handling capacity through more effective use of space and equipment.

Vol 14 Table 10.2.1 Socio-economics - construction worker numbers

Contractor					Client	
Staff*		Labour**			Staff***	
08:00-18:00	18:00-08:00	08:00-15:00	15:00-23:00	11:00-08:00	08:00-18:00	18:00-08:00
80	20	90	90	75	65	6

** 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.*
Note: Shift work for the site means that not all workers working on the Kirtling Street site would be on-site at any one time. The maximum number of workers on-site is during the daytime shifts: 08:00-18:00 and 08:00-15:00.

Code of Construction Practice

10.2.10 Measures applicable to all sites incorporated into the *Code of Construction Practice (CoCP)*[ii] *Part A* to limit significant adverse air quality, construction dust (Section 7), noise, vibration (Section 6), and visual effects (Section 4) could also reduce socio-economic effects, particularly amenity effects.

10.2.11 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[iii] 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. This would effectively ensure that any socio-economic effects during construction are temporary (see Section 4 within the *CoCP Part A*).

10.2.12 The *CoCP Part A* and *Part B* confirm that the length and duration of the diversion of the Thames Path would be minimised, that advance notice of the diversion would be given and that it would be adequately signed (see Section 5.3 within the *CoCP Part A* and Section 5 within the *CoCP Part B*).

10.2.13 Further site specific measures, which could reduce socio-economic effects and particularly amenity effects, are incorporated into the *CoCP Part B*. See the *CoCP* 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) for details on the type of measures that would be employed.

[ii] *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).

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

10.3 Assessment methodology

Engagement

10.3.1 Vol 2 Section 10 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment *of socio*-economics are presented in Vol 14 Table 10.3.1.

Vol 14 Table 10.3.1 Socio-economics - stakeholder engagement

Organisation	Comment	Response
London Borough (LB) Wandsworth, May 2011	Noise, air quality and visual effects should be scoped in, and considered in relation to impact on existing houseboats and expected nearby future development (at Tideway Industrial Estate and Battersea Power Station).	An assessment of amenity effects caused by air quality, noise and visual impacts was scoped in, and has been undertaken in this assessment. The assessment has considered all residential receptors present in the base case, including future developments and houseboats, as appropriate.
LB Wandsworth, May 2011	It is indicated that alternatives for the existing houseboat moorings would be considered, the full impact of these alternatives and impact on the houseboats needs to be considered in the *Environmental Statement*.	The houseboats at Nine Elms Pier have been included as receptors in the assessment and construction has been planned with the location of the houseboats in mind.
Port of London Authority, February 2012	The existing and consented capacity of the safeguarded wharf must be retained during the construction period or the operator (re)located. Furthermore, the permanent works or structures situated on the wharf following the construction works must not affect the site's viability for cargo-handling.	The capacity of the safeguarded wharf facility would be retained during construction and operation at the site. The Cemex concrete batching works would be reconfigured within the existing site during construction and reinstated after construction, in order to enable the ongoing handling of cargo and operation of the business.
London Councils, February	The noise, pollution and congestion caused by site traffic will impact on quality	Consideration of the impact of the proposed development on residential

Organisation	Comment	Response
2012	of life for local residents.	amenity has been considered as part of this assessment.
Greater London Authority (incl. Transport for London), February 2012	The impact of the proposed diversion of the Thames Path along Nine Elms Lane will need assessing and appropriate mitigation put forward, including pedestrian crossings, diversionary signage etc which will need to be discussed further. An improved Thames Path and public realm should be re-instated, appropriate to this location.	Safe pedestrian crossing facilities and diversionary signposting, etc, for diverted sections of the Thames Path is provided for within Section 5.3 of the *CoCP Part A*. Consideration of the effect on users of the Thames Path from its diversion is included in this socio-economic assessment.

Baseline

10.3.2 The baseline methodology follows the methodology described in Vol 2 Section 10. There are no site specific variations for identifying the baseline conditions for this site.

Construction

10.3.3 For this site, the base case is the peak year of construction works. The assessment area is as set out in Vol 2 Section 10.5.

10.3.4 The assessment methodology for the construction phase follows that described in Vol 2 Section 10. There are no site specific variations for undertaking the construction effects assessment of this site.

10.3.5 Section 10.5 details the likely significant effects arising from the construction at Kirtling Street. Another nearby Thames Tideway Tunnel project site which could give rise to additional effects on the Thames Path is Heathwall Pumping Station. This site is therefore included in this assessment.

10.3.6 Of the developments listed in the site development schedule (see Vol 14 Appendix N), there are several which have been considered relevant as receptors for the construction base case assessment. These developments are:

a. Riverlight, located adjacent to the proposed construction site, including residential, commercial and community / social floorspace would be fully complete and operation by the base case year (see para. 10.3.3).

b. New Covent Garden Market (NCGM), located adjacent to the site, which would involve redevelopment of the wholesale market south of the railway viaduct and new residential-led mixed use redevelopment scheme mostly located along Nine Elms Lane. Three of the nine residential buildings, Buildings B4, B5 and B6 on the former Flower

Market part of NCGM, would be complete and operational in the base case year.

c. Battersea Power Station, located 55m to the west, including residential, associated community and social facilities, retail and entertainment floorspace. Three of the seven development phases would be complete and operational in the base case year.

d. Embassy Gardens – located 130m to the east, which would include residential and associated commercial floorspace, social and community facilities. Five of the nine buildings would be complete and operational in the base case year.

10.3.7 These developments are relevant to the assessment of effects on the Thames Path and to the amenity effect assessment on nearby residents because they would either be partly or fully complete and operational by the base case, thereby altering the existing baseline by affecting the provision of recreational assets (eg, public open amenity space) nearby the site and by increasing the number of potentially sensitive receptors, predominantly residential receptors, within 250m of the site (ie, the assessment area for amenity effects as set out in Vol 2 Section 10).

10.3.8 Of the developments listed in the site development schedule (see Vol 14 Appendix N), there are four within the relevant assessment areas (for the types of effects considered within this assessment) which would be under construction in the construction base case year and which have therefore been considered in the construction effects cumulative assessment. These developments are:

a. Battersea Power Station – part of which would be under construction at the same time as the Thames Tideway Tunnel project peak year construction works at the site.

b. New Covent Garden Market – part of which would be under construction at the same time as the Thames Tideway Tunnel peak year construction works at the site

c. Embassy Gardens – a residential scheme that would be under construction both in Site Year 1 of construction and the peak year.

d. Nine Elms Parkside – this site would be under construction at the same time as the Thames Tideway Tunnel project peak year construction works at the site.

10.3.9 The above developments, which are located within approximately 250m or less of the site or which have been assessed for amenity related cumulative impacts by the air quality, construction dust, noise and vibration, and visual cumulative effect assessments, could potentially lead to cumulative amenity impacts on nearby sensitive receptors.

10.3.10 The assessment of construction effects also considers the extent to which the effects on socio-economics 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

10.3.11 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 10. The assumptions specific to this assessment of this site are presented below. There are no limitations specific to the assessment of this site.

Assumptions

10.3.12 That the construction of Riverlight means that the Thames Path would be diverted either through the Riverlight site or to the south of the site along Nine Elms Lane until the Riverlight development is scheduled to be 100% complete and operational.

10.3.13 That the industrial buildings, comprising open yards, warehouses and storage facilities (several of which are situated within the construction area boundary) are largely vacant, and that these facilities would either remain vacant and unused in the construction base or that any occupiers would be short term. This assumption is supported by the fact that these facilities are also situated on land which is designated for redevelopment as part of the wider regeneration of the area, including for the Battersea Power Station project, and are no longer designated for employment use.

10.3.14 Residents of the houseboats at Putney Pier who may be eligible for temporary re-housing would be re-housed only during those periods when noise levels exceed the thresholds given in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* (see Schedule 2 of the *Statement of Reasons*, which accompanies this application). It has been assumed that they would return to their houseboats between the intervening period. The effect of temporary re-housing would therefore be short term for the houseboat residents who take up the option for the first period of temporary re-housing and medium term for the second period of temporary re-housing.

10.3.15 It has been assumed that houseboat residents who take up the option of temporary re-housing would be re-housed on-land in rented flats or serviced apartments.

10.3.16 It has been assumed not all residents would be able to be accommodated in rented accommodation within walking distance of their current location as the Battersea / Nine Elms area is more commercial and industrial in nature and undergoing steady redevelopment. As such, it is considered that residents would be relocated within a search area of approximately 1,600m on the same side of the river from their current location at the Nine Elms Pier.

10.3.17 It is assumed for the purposes of this assessment that reasonable costs and expenditure incurred in association with relocation would be met by Thames Water, including but not limited to removal expenses and the costs of securing new premises, in accordance with the *Thames Tideway Tunnel compensation programme* (included within Schedule 2 of the *Statement of Reasons*, which accompanies this application).

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 ecomonic 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 local areas (within 1km) surrounding the site predominantly comprise light industrial and warehouse employment premises (see Vol 14 Figure 2.1.2 - separate volume of figures). There is a small cluster of residential dwellings to the south of the site (beyond Nine Elms Lane) mainly in purpose built blocks of varying ages. There are also recreational land uses within 250m of the site, including the River Thames and Thames Path.

Community profile

10.4.3 A detailed community profile is outlined in Vol 14 Appendix H.1[iv]. The following points provide a summary of the community profile and provide context for this socio-economic assessment:

a. The resident population was approximately 1,150 within 250m of the site and approximately 36,600 within 1km of the site at the time of the last census for which data is available[v].

b. The proportion of under 16 year olds within 250m (16.4%) and 1km (15.9%) of the proposed construction site is broadly in line with the LB of Wandsworth level (16.3%). Within the above assessment areas however, the proportion of under 16 year olds is somewhat lower than the Greater London average (20.2%).

c. Within 250m the proportion of over 65 year olds (18.3%) is considerably higher than within 1km of the site (12.8%), the LB of Wandsworth (10.4%) and Greater London (12.4%).

d. Within 250m of the site, White residents comprise approximately two thirds of the population (68.7%). This is broadly in line with the proportion within both 1km of the site (73.7%) and within Greater London overall (71.2%).

e. Black residents comprise 14.9% residents within 250m, slightly higher than within 1km (13.6%) and somewhat higher than the LB of Wandsworth and Greater London levels (9.6% and 10.9% respectively).

f. The proportion of residents suffering from a long term or limiting illness within 250m of the site (19.9%) is somewhat higher than within 1km (16.3%) and the Greater London average (15.5%), and considerably

[iv] Information sources are provided in the appendix.

[v] Census 2001. This type of data for the 2011 Census had not been released at the time of the assessment.

higher than the LB of Wandsworth average (13.4%). Those residents who claim disability living allowance within 250m and 1km (6.4% and 5.4% respectively) are considerably higher than both the LB of Wandsworth levels (3.9%) and Greater London levels (4.5%).

g. General health is poor in the local areas surrounding the site, with moderate rates of adult and child obesity. While there is a high instance of adults undertaking physical exercise, children undertaking physical activity fall within the second lowest quintile (ie, the lowest being the worst) of all the Greater London boroughs. Death rates caused by major illnesses in the local area are relatively high compared with Greater London overall, while male and female life expectancy is also relatively low relative to Greater London.

h. There are significant levels of deprivation within 250m of the site, with income deprivation (74.1%) and overall deprivation (53.2%) over three times as high as Greater London levels. Income deprivation and overall deprivation levels drop notably within a 1km radius (28.8% and 19.5% respectively) but remain twice as high as Greater London levels.

10.4.4 The above profile suggests that the local community is predominantly comprised of White or Black residents. It has a high proportion of people who are aged over 65 years, as well as generally poor health and low life expectancy. Residents are not prosperous on the whole and experience significantly higher than average levels of deprivation within 250m of the site in comparison to Greater London.

10.4.5 As outlined in the base case (see para. 10.4.36a) and cumulative effects assessment (see para. 10.3.8) sections the Vauxhall Nine Elms Battersea (VNEB) Opportunity Area is subject to a significant level of redevelopment. There would be a notable increase in the number of residential dwellings by the base case year. As such, it can be expected that the demographic profile within the area would change in the years leading up to construction. At this stage it is not possible to anticipate how these changes may impact the community profile of the area.

Economic profile

10.4.6 A local economic profile (based on 2012 data) is outlined in Vol 14 Appendix H.2. The following points provide a summary of the profile and provide context to this socio-economic assessment:

a. Within approximately 250m of the site there are approximately 1,800 jobs and 170 businesses. [vi]

[vi] 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.

b. The three leading employment sectors as measured by employment within approximately 250m reflect the largely industrial and warehousing land uses surrounding the site. These are the Wholesale and Retail Trade; Administrative and Support Services; and Transportation and Storage sectors.

c. These three sectors are also the leading sectors as measured by number of businesses within approximately 250m.

d. At all geographical levels, most businesses fall within the smallest size band (1 to 9 employees). However, within approximately 250m of the site, businesses appear on average to be slightly larger than within both LB of Wandsworth and Greater London as a whole.

e. Across each of the leading sectors measured by employment and number of businesses within 250m, the vast majority of businesses are small (having less than 25 employees).

Receptors

Businesses – Brooks Court

10.4.7 There are eleven commercial office properties in a uniformly styled small office complex known as Brooks Court situated within the southwest of the proposed construction site. Nine of the offices are semi detached and form a terraced block facing Kirtling Street, while there are a further two offices situated directly north across a small courtyard. There are understood to be three current occupiers of the office premises including a communications agency, a surveying firm and the branch of a government agency. See Vol 14 Figure 10.4.1 (separate volume of figures) which shows the location of this receptor.

10.4.8 The precise number of people employed by the businesses is not known. Based on the nature of the businesses, and the size of the units they occupy, it is estimated that each of the three businesses would be classified as a small (10 to 49 employees) size enterprise.

10.4.9 The factors affecting the sensitivity of businesses and employees at Brooks Court to the displacement of their operations are as follows:

a. Given the nature of the activities taking place on site, it is likely that the businesses are not critically dependant on retaining their current location, but could replicate their operations at other office premises within LB of Wandsworth or in the wider London area. Similarly, while customers and clients may at present come to the offices to do business, it is likely that businesses of this type would be able to retain their customers when they moved, and that staff would find it reasonably easy to travel to a new location.

b. The availability of alternative employment premises of a similar type (as defined by the Use Classes Order, 1987[2]). The LB of Wandsworth Employment Land Study (ELS) (2010) indicated that of the total office floorspace in the borough (448,495m^2 of B1a use classes), 7% (33,269$m^{2)}$ was vacant. For the VNEB Opportunity Area, where the site is located, vacancy was estimated to be slightly higher than the borough average at 8% (4,566m^2) of the Locally Significant Industrial Areas[vii] (LSIA) total floorspace (55,427m^2) (LB of Wandsworth, 2012)[3].

c. There would be an increase in the office stock of the VNEB Opportunity Area leading up to (and after) the peak construction year, due to the ongoing redevelopment of the area. As such, new alternative premises are likely to become available over the short to medium term.

10.4.10 On the basis of these factors, it is considered that the sensitivity of businesses at Brooks Court to the loss of their premises would be medium.

Business – concrete batching works

10.4.11 The Cemex concrete batching works lies within the western portion of the proposed construction site and is accessed via Cringle Street. The business is bounded to the north by the River Thames and to the west by the Cringle Dock Waste Transfer Station.

10.4.12 The current permanent employment on site is understood to be approximately two to three workers, plus associated employment for a further five to ten lorry drivers. In terms of on site employment the business is therefore considered to be equivalent in size to a micro enterprise (one to nine employees).

10.4.13 This portion of the construction site is not allocated for employment uses but it is identified by the GLA as the Kirtling Street Safeguarded Wharf (also referred to as Kirtling Wharf). It is recommended for retention as such in a recent London wide review of safeguarded wharves (GLA, 2011)[4]. The operation on site makes use of its wharf facility.

10.4.14 See Vol 14 Figure 10.4.1 (separate volume of figures) which shows the location of this receptor.

10.4.15 The main factors affecting the sensitivity of the concrete batching works to a temporary reduction in the size of its operating area are as follows:

a. The company's ability to respond to increases in demand for its products in the immediate vicinity could be constrained, particularly in the VNEB Opportunity Area which is likely to see strong demand for concrete products and services as it undergoes substantial regeneration.

b. The site is a safeguarded wharf and the current occupiers make use of the wharf facility. There are only a limited number of available wharf facilities in London. Alternative sites, of similar size, offering wharf facilities and with a comparable location and transport network access characteristics, are likely to be relatively limited in number and availability.

[vii] At the time of the publication of the LB of Wandsworth ELS the site fell within a designated LSIA, however this designation has since been removed and is no longer applicable to the proposed construction site.

10.4.16 Based on the above factors, it is considered that the business on the site would have a high level of sensitivity to a temporary reduction in the size of its operating area.

Business – Duck Tours vehicle storage facility

10.4.17 A warehouse used for vehicle storage is privately operated and used solely by Duck Tours, which operate DUKW amphibious vehicles to provide a year round land and river tour bus service (London Duck Tours, 2012)[5].

10.4.18 The warehouse is situated to the south of Cringle Street, bounded to the west by Kirtling Street. This premise is understood to be the main storage facility for the business' vehicles.

10.4.19 The number of employees at the facility is not known however given the site is used for storage there are not likely to be many staff permanently based on site. At most it is estimated that employment on site would be equivalent to a micro size enterprise (one to nine employees).

10.4.20 See Vol 14 Figure 10.4.1 (separate volume of figures) which shows the location of this receptor.

10.4.21 The factors affecting the sensitivity of the business and employees at the storage facility to displacement of their activities are as follows:

a. It is likely that the nature of the activities taking place on site are such that they could be replicated at other warehousing premises within the LB of Wandsworth or in the wider Greater London area, although these premises would need to offer a similar level of accessibility to the River Thames and the business' operating route.

b. The premises are not used for a direct customer role and customers do not have to visit the facility to use Duck Tour's river tour service, so customers, and the business' level of custom, would not be directly affected by the displacement of the storage facility to an alternative location.

c. The availability of alternative employment premises of a similar type (as defined by the Use Classes Order) is outlined in the LB of Wandsworth ELS, which indicated that of the total warehouse floorspace within the borough (508,543m^2 of B8 use classes), 24% was vacant (LB of Wandsworth, 2012)[6]. Given the current state of the economy, it is expected that net absorption of vacant warehousing floorspace by the market over coming years will be relatively slow.

10.4.22 On the basis of these factors, it is considered that the sensitivity of the business to the loss of its premises would be medium.

Thames Path

10.4.23 The Thames Path is a recreational asset and national trail. It follows the River Thames for almost its entire length, and in west and central London it runs on both sides of the river. At this location it follows a route (from west to east) which runs north from Nine Elms Lane along Kirtling Street to the River Thames through the proposed construction site. To the east, it follows the river past Nine Elms Pier. It then heads back onto Nine Elms

Lane between the Riverlight development site and Heathwall Pumping Station. See Vol 14 Figure 10.4.1 (separate volume of figures) which shows the location of this receptor.

10.4.24 The character of the Thames Path at this point is generally not as pleasant as other parts of the Thames Path in west and central London. The sections along Nine Elms Lane and Kirtling Street do not enjoy an outlook over the River Thames. Instead, the route along Kirtling Street runs past warehouses and semi derelict industrial premises. Kirtling Street is also likely to be used by many heavy goods vehicles in its present state. The Thames Path in this location does not have any seating, and there are few trees. The path is mostly poorly maintained, uneven and cracked in places.

10.4.25 During site visits this section of the Thames Path was not observed to be well used. The few pedestrians observed to be making use of the path appeared to be local residents or employees, rather than visitors to the area or tourists.

10.4.26 These observations are corroborated by the pedestrian surveys undertaken as part of Section 12 of this volume. These recorded a peak two-way flow of 21 pedestrian movements on the Thames Path during the AM peak hour. The Thames Path is therefore considered to be lightly used at this location in the existing baseline.

10.4.27 The main factor affecting the sensitivity of users of the Thames Path is the availability of alternatives. As a metropolitan wide recreational asset, users have access to many alternative and comparable (if not better) stretches of the Thames Path on both sides of the river across west and central London. More locally, there is an alternative route available of comparable length and quality.

10.4.28 In terms of their sensitivity to amenity impacts, users of the Thames Path are only likely to be in the vicinity for the time that it takes them to pass by (likely to be a minute or two for most users). Therefore the duration for which users would experience any amenity effects would be limited.

10.4.29 Accordingly, it is considered that users of the Thames Path in this location would have a low level of sensitivity to diversion and impacts that would cause a loss of or reduction in amenity.

Residential

10.4.30 There are existing and base case residential developments near the proposed construction site as identified in the air quality, construction dust, noise, vibration and visual assessments.

10.4.31 Land that is predominantly used for residential development is shown in the Land use plan for this site (see Vol 14 Figure 2.1.2, separate volume of figures).

10.4.32 It is considered that the sensitivity of nearby residents to overall amenity effects would vary by time of day, with residents being somewhat less sensitive to amenity effects, particularly noise, during the day and more sensitive to such effects during the evening and night. In respect of temporary re-housing of houseboat residents (see para. 10.1.2), it is considered that the sensitivity of residents to such effects would be high.

10.4.33 Therefore, as outlined in the methodology for this socio-economic impact assessment (see Vol 2 Section 10) the sensitivity of nearby residential receptors to amenity impacts would be medium during the day and high during the evening and night.

Summary

10.4.34 A summary of receptors as described in the baseline and their sensitivity is provided in Vol 14 Table 10.4.1.

Vol 14 Table 10.4.1 Socio-economics - receptor values / sensitivities

Receptor	Value / sensitivity and justification
Businesses – Brooks Court	Medium – moderate availability of alternative employment premises within LB of Wandsworth. Businesses are unlikely to be completely reliant on their current location for continued operation.
Business – concrete batching works	High – the company's ability to respond to future increases in demand would be constrained by a reduction in its operating area. There is also limited availability of comparable alternative sites.
Business – Duck Tours vehicle storage facility	Medium – there are some alternative potential premises within the borough, although the business likely derives some benefit from its current location given the proximity to Duck Tours operating route.
Users of the Thames Path	Low – alternative routes include the eastern arm of Kirtling Street and pavements on either side of Nine Elms Lane. Alternative but comparable (or better) stretches of the Thames Path are also easily accessible. In terms of amenity impacts, users would be near the site for a short duration.
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. Residents would also have high sensitivity to temporary re-housing if it were to occur.

Construction base case

10.4.35 The construction assessment year and area are as set out in para. 10.3.3.

10.4.36 The base case in the peak year of construction, taking into account the schemes described in para. 10.3.6, would differ from the baseline in the following ways:

a. The base case would include additional residential receptors within 250m of the site that could potentially be affected by amenity impacts arising from the proposed development. These new residential receptors are identified in the air quality, noise and vibration and townscape and visual assessments.

b. The residential developments along the riverside which would be completed and operational in the base case (particularly Riverlight) would result in the gradual opening up of the riverfront for amenity space and the extension of the Thames Path.

c. These proposals, together with proposals in the wider VNEB Opportunity Area, would be likely to increase the number of people using the Thames Path on a regular basis in the area. It is assumed that the number of users would gradually increase from the existing levels as developments are completed and occupied, but that user numbers would not peak until sometime after the completion of construction.

10.4.37 Other than the above, it is considered that the other base case socio-economic conditions at the site would remain largely the same as existing baseline conditions.

10.5 Construction effects assessment

Displacement of businesses – Brooks Court

10.5.1 The construction works would result in the demolition of 11 commercial office units which fall within the construction works area boundary, and the permanent displacement of businesses which occupy these units.

10.5.2 The magnitude of the impact is influenced by several factors:

a. Although the construction is temporary, the displacement and impact for the businesses would effectively be permanent.

b. In terms of the number of businesses which would be displaced, there are three currently known to be in occupation at Brooks Court (this may suggest that demand for the commercial space of this type at Kirtling Street is modest).

c. The precise number of people employed by the businesses is not known. Based on the nature of the businesses and the size of the units it is estimated that each of the three businesses would be classified as a small (10 to 49 employees) size enterprise.

d. It is assumed that that the businesses do not critically depend on their location at this site to attract custom, as they are office based and would be able to ‘carry’ their customers with them to new locations elsewhere.

e. Alternative locations for the businesses have not yet been identified; accordingly, it is not possible to take the new location of the businesses into consideration for the purposes of this assessment.

f. The effect on the businesses of relocating could be potentially significant as there would be costs and expenditure associated with the move including but not limited to removal expenses, legal and surveyor fees, taxes, costs of securing and adapting new premises, temporary loss of profits during the period of the move, and diminution of goodwill following the move (reflected in reduced profits). If the businesses failed as a result of the relocations, their employees could potentially lose their jobs.

g. However, in accordance with the *Thames Tideway Tunnel compensation programme* (included within Schedule 2 of the *Statement of Reasons*, which accompanies the application), compensation would be available. Given that Thames Water would comply with the provisions of the programme, it is assumed for the purposes of this assessment that reasonable costs and expenditure incurred in association with the relocation of the businesses would be met.

10.5.3 Taking account of the above, it is considered that the impact on businesses as a result of their permanent displacement would be low.

10.5.4 Given the low magnitude of impact and the medium sensitivity of businesses to permanent displacement, it is assessed that the effect on businesses at Brooks Court would be **minor adverse**.

Temporary reconfiguration of operations – Cemex works

10.5.5 The construction works would result in the partial take up of land at the concrete batching works and the reconfiguration of Cemex's operations into a smaller site. The reconfiguration would involve redevelopment to provide consolidated site operations to allow the site to be able to accommodate the Thames Tideway Tunnel project works.

10.5.6 The concrete batching works would remain operational on the site throughout the Thames Tideway Tunnel project works (in a reduced area of their current site), and would extend back into the full site after the completion of construction works with Thames Water retaining a right of access to the shaft for maintenance purposes in the operational phase.

10.5.7 The magnitude of the impact is influenced by the following factors:

a. The effect would last for six years and therefore would be long term.

b. It is understood that the capacity and output of the batching works, and the existing levels of employment on the site (estimated to be one to nine employees, equivalent to a micro size enterprise), would be retained during construction.

c. In accordance with the *Thames Tideway Tunnel project compensation programme* (included within Schedule 2 of the *Statement of Reasons*, which accompanies the application), compensation would be available. Given that Thames Water would comply with the provisions of the programme, it is assumed for the purposes of this assessment that reasonable costs and expenditure incurred in association with the reconfiguration would be met.

10.5.8 Taking account of the above, the magnitude of the impact arising from the temporary reconfiguration of operations at the Cemex works would be negligible.

10.5.9 Given the negligible magnitude of impact and the high sensitivity of the business on the site, it is assessed that the effect on the business and its employees would be **minor adverse**.

Displacement of business – Duck Tours vehicle storage facility

10.5.10 The construction works would result in the displacement of the storage facility used by Duck Tours at the site.

10.5.11 The magnitude of the impact is influenced by several factors:

a. Although the construction is temporary, the displacement and effect for the business would most likely effectively be permanent as, once settled at new premises, the business would probably not choose to return to the existing site.

b. An alternative location for the business has not yet been identified. Although available data indicates that there is reasonable level of vacant warehouse floorspace within LB of Wandsworth, a site which offers comparable access to the business' operating route could be more difficult to secure.

c. The number of people employed by the business is not known, but it is estimated that at most permanent on-site employment would be equivalent to a micro size enterprise (ie, one to nine employees).

d. It is likely that that the business does not critically depend on its location at this site to operate or attract custom, as their customer facing tour service takes place elsewhere. Therefore the volume of custom they receive would not be affected directly by the displacement of their storage facility.

e. Alternative locations for the storage facility have not yet been identified; accordingly, it is not possible to take the new location of the facility into consideration for the purposes of this assessment.

f. The effect on the business of relocating this facility could be potentially significant as there would be costs and expenditure associated with the move including but not limited to removal expenses, legal and surveyor fees, taxes, costs of securing and adapting new premises, and temporary loss or reduction of profits during the period of the move.

g. However, in accordance with the *Thames Tideway Tunnel project compensation programme*, compensation would be available. Given that Thames Water would comply with the provisions of the programme, it is assumed for the purposes of this assessment that reasonable costs and expenditure incurred in association with the relocation of the storage facility would be met.

10.5.12 Taking account of the above, it is considered that the impact on business as a result of the displacement of its storage facility would be low.

10.5.13 Given the low magnitude of the impact and the medium sensitivity of the receptor, it is assessed that there would be a **minor adverse** effect on the business arising from its displacement from this site.

Temporary diversion of social infrastructure – Thames Path

10.5.14 The proposed development would require closure of a stretch of the Thames Path and provision of a signposted diversion route during the construction phase. The Thames Path would be diverted via the eastern arm of Kirtling Street and the pavement along Nine Elms Lane to the south of the proposed construction site during the construction phase for a period of approximately six years.

10.5.15 The magnitude of the impact is influenced by the following factors:

a. The diversion would be of a similar length as the existing route of the Thames Path, and run in a route of comparable appearance. Given the intention to install adequate signage, the diversion route should not be disorientating for users and it is unlikely that users would experience significant delays and inconvenience.

b. The diversion would occur over a long term period.

c. Although the Thames Path at this location is lightly used in the existing baseline, the diversion would affect a moderate and increasing number of users as residential developments within the surrounding area were completed and occupied prior to the base case, the point in time for which this assessment is made. Many would be likely to be local residents and employees rather than occasional recreational users, including tourists.

10.5.16 On the basis of the above factors, the magnitude of impact would be low.

10.5.17 Taking account of the low magnitude of impact and the low sensitivity, it is considered that the effect on users to the temporary diversion of the Thames Path would be **negligible**.

Effect on the amenity of Thames Path users

10.5.18 Assessments have been undertaken to examine the 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 (see Section 4, Section 9, and Section 11). The following points summarise the residual effect findings of those assessments in relation to the Thames Path:

a. Local air quality effects would be **negligible**. Construction dust effects would be **minor adverse**.

b. No noise, vibration (human response) receptors or viewpoints (within 250m and on the same side of the river) were identified as requiring assessment at the proposed construction site in relation to users of the Thames Path.

10.5.19 In assessing the overall magnitude of impact, the above findings have been taken into consideration together with the following factors that are considered relevant to the receptor's overall experience of amenity at this site:

a. Given the six year construction programme, the effect noted above would be likely to be experienced over a long term period.

b. Although the Thames Path at this location is lightly used in the existing baseline, any amenity effects would affect a moderate and increasing number of users as residential developments within the surrounding area were completed and occupied prior to the base case, the point in time for which this assessment is made. Many would be likely to be local residents and employees rather than occasional recreational users, including tourists.

c. Users would only be exposed to amenity impacts for a short period, ie, the time it takes to pass by the site (likely to be a minute or two for most users).

d. It is also noted that the effect assessments have been conducted having regard to the base case, which would change significantly as new developments in the nearby area are completed, including Riverlight to the immediate east of the site.

10.5.20 On the basis of the above findings and factors, it is considered that the overall amenity impact magnitude would be negligible.

10.5.21 Taking account of the negligible impact magnitude and the low sensitivity of the receptor, it is considered that the effect on the amenity of Thames Path users would be **negligible**.

10.5.22 While a very high proportion of Thames Path users would be likely to pass by both the Kirtling Street and Heathwall Pumping Station sites, given that negligible amenity effects are predicted at Heathwall also, it is considered that there would not be any significant additional amenity effects.

Effect on the amenity of residents

10.5.23 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 (see Section 4, Section 9 and Section 11). The following points summarise the residual effect findings of those assessments in relation to nearby residential receptors:

a. Local air quality effects would be **minor adverse** at three of the five residential receptors identified and **negligible** at the remaining two. Construction dust effects would be **minor adverse** at three of the five receptors and **negligible** at the remaining two receptors.

b. Noise effects on residents would be **significant** at seven of the 11 residential receptors identified (Nine Elms Pier houseboats, Riverlight Blocks A to C and Battersea Power Station Blocks PS, O1 and RS4)[viii]. This finding is informed in part by the estimate that construction noise levels would exceed the potential significance criteria for a residential receptor at Nine Elms Pier houseboats during the day for 25 months,

[viii] The noise and vibration assessment reports that the residual noise effect for six receptors (Riverlight blocks A, B and C and Battersea Power Station Blocks PS, O1 and RS4) is considered significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant (see Vol 14 Section 9.9).

and during the evening and night for 22 months; at Riverlight Block A during the day for 19 months and during the night for 19 months; at Riverlight Block B during the day for 68 months and during the evening and night for 37 months; at Riverlight Block C during the day for 24 months and during the night for three months; at Battersea Power Station Block PS during the day for 68 months and during the evening and night for 22 months; at Battersea Power Station Block O1 during the night for 19 months; and at Battersea Power Station Block RS4 during the day for 37 months and during the evening and night for 19 months. Noise effects would be **not significant** at the other four receptors. The noise assessment states that the change in noise level due to construction traffic is considered to be **not significant** to receptors adjacent to the proposed vehicle route on Cringle Street (Battersea Power Station) and Kirtling Street (Riverlight). In relation to river-based construction traffic, the noise assessment found that noise effects would be **not significant** at the two relevant residential receptors (Nine Elms Pier and Battersea Power Station).

c. Vibration (human response) effects would be **not significant** at any of the 11 residential receptors identified.

d. At those viewpoints within 250m and on the same side of the river, visual effects during the day would be **major adverse** from viewpoint 1.8 **and moderate adverse** from viewpoints 1.4 and 1.5. Visual effects during the night would be **moderate adverse** at viewpoint 1.8 and **negligible** at the other two viewpoints.

10.5.24 In assessing the overall magnitude of impact, the above findings have been taken into consideration together with the following factors that are considered relevant to the overall experience of amenity at this site:

a. Given the six year construction programme, the effects noted above would be likely to be experienced over a long term period. The exceptions are:

   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 they may be negligible in other years.

   ii For noise, the assessment results vary and as such effects would be experienced over different periods of time ranging from short term and medium term periods for effects experienced during the evening and night through to medium term and long term periods for effects experienced during the day.

b. While it is assessed that there would be major and moderate adverse visual effects at all three viewpoints during the day and from one viewpoint at night, 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 are likely to have views in other directions that are either not as severely affected or not affected at all.

10.5.25 On the basis of the above findings and factors, it is considered that the overall amenity impact magnitude would be high.

10.5.26 Taking account of the high magnitude of impact and the high sensitivity of residents during the evening and night, it is considered that the effect on the amenity of a limited number of residential receptors would be **major adverse**.

10.5.27 This assessment relates primarily to those residential receptors that would experience adverse local air quality, construction dust, noise and visual effects. For residential receptors not subject to these effects, it is considered that there would be a lower effect on their amenity. These findings also present a peak year scenario which is relevant in particular during the evening and during the night at this site. Outside of these periods the effect significance is considered to be lower, given the lower sensitivity of residents during the day.

Effect on residents who take up the option of temporary re-housing

10.5.28 As set out in para. 10.1.2, there would be periods within the construction phase when residents may be eligible for temporary re-housing as set out in the Thames Tideway Tunnel noise insulation and temporary re-housing policy (included within Schedule 2 of the *Statement of Reasons*, which accompanies the application).

10.5.29 The magnitude of the impact is influenced by several factors (see Section 10.3 for assumptions relating to this assessment):

a. It is understood that there are approximately 21 houseboats and approximately 50 residents.

b. It is possible that some residents that would be relocated would work from home and so the temporary re-housing would also affect them in terms of the place of work as well as their place of residence.

c. The duration of time when residents of the houseboats may be eligible for temporary re-housing is estimated to be a total of approximately three months during the jetty piling construction activity and approximately 26 months during the main tunnel drive construction activity. These two periods are not continuous and there would be period of approximately 21 months between the end of the jetty piling and the beginning of the tunnel driving activity. The assessment is based on relocation for the periods during which these two activities take place only, with residents relocating back to the houseboats in the intervening period. Although costs and expenditure associated with temporary re-housing would be met, the effect on residents of relocating twice is likely to be disruptive.

10.5.30 On the basis of the above, it is considered that the magnitude of impact would be high.

10.5.31 Given the high magnitude of impact and the high sensitivity of residents to relocation, the effect on those residents that take up the option of relocation during part of the construction period would be **major adverse**.

10.5.32 For those residents that take up temporary re-housing, during the period when they reside in temporary accommodation they would not experience the major adverse amenity effect noted in para. 10.5.26.

Sensitivity test for programme delay

10.5.33 It is considered that 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 or proposed receptors, however there is a possibility of significant noise effect to the New Covent Garden Market Entrance Site and Battersea Power Station block RS-2 receptors. Although, in terms of visual effects, the delay to the programme would result in a re-categorisation of phases of other developments from the cumulative assessment into base case, and thus would result in an increase in the number of visual receptors, the assessment already factors in these viewpoints.

10.6 Operational effects assessment

10.6.1 Operational effects for socio-economics for this site have not been assessed (see para. 10.1.3).

10.7 Cumulative effects assessment

10.7.1 For the purposes of this cumulative assessment, the assessment year is the peak construction year.

10.7.2 As described in Section 10.3, four projects, Battersea Power Station, Embassy Gardens, the Post Office Depot and Riverlight, would be under construction at the same time as the proposed development at Kirtling Street.

10.7.3 In respect of non-amenity related effect assessments undertaken in Section 10.5, as these developments are not located on or within the proposed project site, it would not be possible for them to give rise to cumulative effects in respect of the displacement of the businesses situated within the proposed project site or the diversion of the Thames Path nearby the site. Therefore, the non-amenity related effects on socio-economics would remain as described in Section 10.5.

10.7.4 In respect of the amenity effect assessments undertaken in Section 10.5, the developments are located within the assessment area for amenity effects and so they could give rise to cumulative effects on the amenity of potentially sensitive receptors such as residents and Thames Path users.

10.7.5 The other topic assessments of amenity related cumulative effects (see Section 4, Section 9 and Section 11) have concluded that:

a. For air quality and construction dust that the cumulative effect has been accounted for and that there would be no additional cumulative effects

b. For noise and vibration (which consider effects on residential receptors but not on the Thames Path); that significantly affected residential receptors would be subject to additional noise from other cumulative major developments and that additionally, there is a likelihood of cumulative additional significant effects on two other residential receptors that would not be significantly affected by the proposed construction site at Kirtling Street alone.

c. For visual effects, the assessment found that effects on one residential receptor and four receptors on pedestrian routes running across Vauxhall Bridge and Chelsea Bridge would be significant when taking into account construction at the developments. However, none of these viewpoints are within the 250m amenity assessment limit of the site.

10.7.6 Therefore, it is considered that there would be elevated and significant cumulative amenity effects on residential receptors near the site, and that there could be elevated and significant cumulative amenity effects on users of the Thames Path.

10.7.7 In the event that the programme for the Thames Tideway Tunnel is delayed by approximately one year, more of the Riverlight, Battersea Power Station, Nine Elms Parkside and Embassy Gardens developments would 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.

10.8 Mitigation and compensation

Mitigation

10.8.1 The above assessment has concluded that there is potential for a major adverse effect on the amenity of nearby residents.

10.8.2 The assessment relating to amenity effects is based on the residual findings of the air quality, construction dust, noise, vibration and visual effect assessments. Where practicable and applicable, embedded measures have been included and no further practicable measures or mitigation can be adopted above those methods identified in the *CoCP Part A and Part B*.

10.8.3 In relation to the temporary re-location of the houseboat residents, this measure has been identified as a means to offset significant adverse noise effects (identified in Vol 14 Section 9.5) however the consequence of the relocation process is to give rise to a significant adverse socio-economic effect from the physical relocation. There are no further practicable mitigation measures that can be adopted.

Compensation

10.8.4 A compensation programme has been established (see Schedule 2 of the *Statement of Reasons*, which accompanies the application) relating to construction disturbance - for example, noise, dust, vibration, and/or light disturbance from worksites at night. The programme has been established to address claims of exceptional hardship or disturbance.

10.8.5 In relation to the effects on residential amenity, the *Thames Tideway Tunnel compensation programme* measures are not considered to be mitigation as there is no guarantee that the properties in question would be eligible for compensation or that the compensation would be accepted by the affected party. The residual effects reported in this *Environmental Statement* do not therefore take the offsetting effects of these measures into account. Further information is contained in the Thames Tideway Tunnel Compensation Programme (see Schedule 2 of the *Statement of Reasons*, which accompanies the application).

10.9 Residual effects assessment

Construction effects

10.9.1 As discussed in para.10.8.5, the residual effects reported in this *Environmental Statement* do not take the offsetting effects of compensation into account as there is no guarantee that the properties in question would be eligible for compensation or that the compensation would be accepted by the affected party. As a result the residual amenity effects would remain as described in Section 10.5.

10.9.2 In relation to the residents of the houseboats, as there are no further practicable mitigation measures that can be adopted residual effects would remain as described in Section 10.510.5.

10.9.3 All residual effects are presented in Section 10.10.

10.10 Assessment summary

Vol 14 Table 10.10.1 Socio-economics - summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect	Compensation
Businesses – Brooks Court	Displacement of businesses	Minor adverse	None	Minor adverse	
Business – concrete batching works	Temporary reconfiguration of business	Minor adverse	None	Minor adverse	
Business – Duck Tours vehicle storage facility	Displacement of business	Minor adverse	None	Minor adverse	
Users of the Thames Path	Temporary diversion of a section of the Thames Path	Negligible	None	Negligible	
Users of the Thames Path	Effect on the amenity of Thames Path users'	Negligible	None	Negligible	
Residents	Effect on the amenity of residents (as described in para. 10.5.26 and para. 10.5.27)	Major adverse	No further on site mitigation practicable.	Major adverse	Compensation mechanisms available for amenity related disturbance during the construction phase
Residents (of the houseboats who may be eligible for temporary re-housing)	Effect on residents who may be eligible for and take up the option of temporary re-housing	Major adverse	No further on site mitigation practicable	Major adverse	Reasonable costs and expenditure associated with temporary re-housing would be met

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. Accessed November 2012

[2] Town and Country Planning Act. *Use classes order* (1987). Available from: http://www.legislation.gov.uk/uksi/1987/764/contents/made. Accessed on 29 May 2012.

[3] LB of Wandsworth. *Wandsworth Employment Land Study* (2010). Available from: http://www.wandsworth.gov.uk/downloads/file/3363/employment_land_study_2010_main_report. Accessed on 29 May 2012.

[4] Greater London Authority. *Safeguarded Wharves Review 2011/12* (2011). Available from: https://www.london.gov.uk/consultation/safeguarded-wharves-review. Accessed on 29 May 2012.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 11: Townscape and visual

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Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling 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 Kirtling Street. 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 construction phase assessment includes effects on townscape character areas and visual effects during daytime and also night time to take account of effects arising from additional lighting. The operational phase assessment includes effects on townscape character areas and visual effects during daytime for both winter and summer of Year 1 and summer only for Year 15. The assessment also identifies mitigation measures where appropriate.

11.1.3 Effects arising from lighting during the operational phase have not been assessed. This is on the basis that there would not be any significant effects (this is further explained in para.11.3.17).

11.1.4 Each section of the assessment is structured so that townscape aspects are described first, followed by visual.

11.1.5 The assessment of the likely significant townscape and visual effects of the project has considered the requirements of the National Policy Statement (NPS) for Water (Defra, 2012)[1]. In line with these requirements, the townscape and visual assessment considers effects during construction and operation on townscape components, townscape character and visual receptors. The construction and design of the proposed development also takes account of townscape and visual considerations in line with the NPS recommendations. Vol 2 Section 11 provides further details on the methodology.

11.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling 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 most likely to give rise to the most substantial townscape and visual effects described first:

a. clearance of the site in advance of works, including demolition of buildings and removal of existing silos within the part of the site operated by Cemex

b. presence of a noise shed enclosing the main tunnel site during the main tunnel drives and secondary lining of the tunnel

c. use of cranes during shaft sinking, the main tunnel drives and secondary lining of the tunnel

d. construction of a river jetty and 24 hour loading of barges during the main tunnel drives

e. provision of welfare facilities, assumed to be a maximum of three storeys in height

f. construction of new silos and buildings within the part of the site operated by Cemex

g. vehicular construction accesses to the site off Nine Elms Lane

h. installation of 3.6m high hoardings around the boundary of the construction site

i. lighting of the site when required (continuously during the connection tunnel drive and secondary lining, lasting approximately 37 months).

Code of Construction Practice

11.2.3 Measures incorporated into the *Code of Construction Practice* (*CoCP*)[i] *Part A* to reduce townscape and visual impacts include:

a. installation of well-designed visually attractive hoardings (Section 4)

b. the use of appropriate capped and directional lighting when required (Section 4).

11.2.4 Measures incorporated into the *CoCP Part B* to reduce townscape and visual impacts include:

[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).*

a. provision for incorporating suitable art work on public facing sections of hoarding (Section 4)

b. use of 3.6m high hoardings(Section 4).

Operation

11.2.5 The particular components of importance to this topic include the:

a. design, siting and materials used for the above ground structures, and the limits of deviation within which these may be located

b. reinstatement of streets within the site boundary following construction.

Environmental design measures

11.2.6 Figures illustrating the proposed development during operation are contained in a separate volume (Vol 14 Kirtling Street Figures – Section 1). Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint in Section 11.6.

11.2.7 Measures which have been incorporated into the design of the proposed development (refer to the Site works parameter plan and Proposed landscape plan in separate volume of figures – Section 1 and to *Design Principles* report in Vol 1 Appendix B) include the siting of the above ground structures in close proximity to other operational structures within the Cemex compound and the reinstatement of the remainder of the construction site following the works.

11.3 Assessment methodology

Engagement

11.3.1 Volume 2 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 Wandsworth, neighbouring authorities the LB of Lambeth and City of Westminster Council, and English Heritage have been consulted on the detailed approach to the townscape and visual assessment, including the number and location of viewpoints. The LB of Lambeth (March 2011) requested an additional view from the centre of Vauxhall Bridge, which has been included in the visual assessment (refer to Vol 14 Figure 11.4.5 – see separate volume of figures). The LB of Wandsworth (May 2011), City of Westminster Council (March 2011) and English Heritage (May 2011) have confirmed acceptance of the proposed viewpoints.

11.3.3 The stakeholders were also consulted on proposed changes to the viewpoints following the preliminary assessment findings, including removing some viewpoints and photomontages, adding some additional viewpoints and removing some viewpoints from the operational assessment. The LB of Lambeth (July 2012) and LB of Wandsworth

(October 2012) confirmed acceptance of the proposed changes. The Royal Borough of Kensington and Chelsea, City of Westminster Council and English Heritage have not commented on the proposed changes.

11.3.4 A description of how the on-site alternatives to the proposed approach have been considered and the main reasons why these alternatives have not been adopted is included in Section 3.6 of this volume.

Baseline

11.3.5 The baseline methodology follows the methodology described in Vol 2 Section 11. In summary, the following surveys have been undertaken to establish baseline data for this assessment:

a. Preliminary site visit to check the zone of theoretical visibility (ZTV), establish the extents of townscape character areas and identify locations for visual assessment viewpoints (March 2011)

b. Photographic surveys of townscape character areas (August 2011)

c. Winter photographic surveys of the view from each visual assessment viewpoint (November 2011, December 2011, January 2012 and February 2012)

d. Summer photographic survey of the view from visual assessment viewpoints considered in the operational assessment (August 2011)

e. Verifiable photography (April 2011 and May 2011) and verifiable surveying (May 2011) for the viewpoints requiring a photomontage to be produced, as agreed with the stakeholders (described in para. 11.3.2).

11.3.6 With specific reference to the Kirtling Street site, baseline information on conservation areas and townscape character has been gathered through a review of:

a. The *Core Strategy* for the LB of Wandsworth (LB of Wandsworth, 2010)[2]

b. The *Core Strategy* for the LB of Lambeth (LB of Lambeth, 2011)[3]

c. The *Core Strategy* for the City of Westminster (City of Westminster, 2011)[4]

d. Pimlico, Churchill Gardens and Dolphin Square Conservation Area General Information Leaflets, produced by the City of Westminster Council (City of Westminster, 2004)[5].

Construction

11.3.7 The assessment methodology for the construction phase follows that described in Vol 2 Section 11. Site specific variations are described below.

11.3.8 With reference to the Kirtling Street site, the peak construction phase relevant to this topic would be from Site Year 3 to Site Year 5 of construction, during the main tunnel drive and subsequent secondary lining, including 24 hour working, the presence of cranes at the site, and export and import of material by barge. Site Year 3 has been used as the assessment year for townscape and visual effects.

11.3.9 Two verifiable photomontages have been prepared for this site to assist the assessment of construction effects. These are shown in Vol 14 Figure 11.5.1 and Vol 14 Figure 11.5.2 (see separate volume of figures).

11.3.10 The assessment area, defined using the methodology provided in Vol 2 Section 11, is indicated in Vol 14 Figure 11.4.4 for townscape and Vol 14 Figure 11.4.5 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 upstream of the site where the construction works would be obscured by Grosvenor Bridge, and downstream of the site with the construction works would be obscured by Vauxhall Bridge. The visual assessment area has been set by the maximum extent of the construction phase ZTV, except in those locations upstream of the site where the construction works would be obscured by Grosvenor Bridge and downstream of the site with the construction works would be obscured by Vauxhall Bridge. All visual assessment viewpoints are located within the ZTV.

11.3.11 The construction assessment area for this site intersects with the assessment areas for the proposed Thames Tideway Tunnel project sites at Heathwall Pumping Station, Albert Embankment Foreshore and Chelsea Embankment Foreshore, therefore likely significant effects on receptors arising from construction at all of these sites are included in this assessment.

11.3.12 For the construction base case for the assessment of effects arising from the proposed development at Kirtling Street, it is assumed that the following developments within the assessment area, identified within the site development schedule (Vol 14 Appendix N), of relevance to the townscape and visual assessment would be complete and occupied by Site Year 3 of construction:

a. Riverlight - a residential led mixed use development to the east of the site

b. phases 1, 2 and 3 of the Battersea Power Station redevelopment, comprising the residential and mixed use plots to the west of the power station and the power station itself

c. buildings B4, B5 and B6 of the New Covent Garden Market development, comprising mixed use plots to the south of the development, adjacent to the site

d. the US Embassy development, 290m east of the site

e. buildings A02, A05, A09, A10 and A11 of the Embassy Gardens mixed use development surrounding the US Embassy development

f. Vauxhall Sky Gardens mixed use development, 900m east of the site

g. St Georges Wharf (Vauxhall Tower) residential development, including a 50 storey tower 870m northeast of the site

h. Market Towers mixed use development 700m to the east of the site, comprising two buildings at 58 storeys and 43 storeys

i. the Northern Line Extension, approximately 420m southeast (to the proposed station at Nine Elms) and 565m southwest (to the proposed station at Battersea Power Station).

11.3.13 For the purposes of the cumulative effects assessment, it is assumed that the following developments, identified within the site development schedule (Vol 14 Appendix N), of relevance to the townscape and visual assessment would be under construction during Site Year 3 of construction at the Kirtling Street site:

a. phase 4, part of phase 5 and phase 6 of the Battersea Power Station development

b. buildings B1, B2, B3 and the site entrance of the New Covent Garden Market development

c. buildings A01, A03, A04 and A07 of the Embassy Gardens development

d. plots B, C and D of the Nine Elms Parkside development

e. Vauxhall Square mixed use development, approximately 820m east of the site.

11.3.14 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.

Operation

11.3.15 The assessment methodology for the operational phase follows that described in Vol 2 Section 11. Any site specific variations are described below.

11.3.16 One verifiable photomontage has been prepared for this site to assist the assessment of operational effects. This is shown in Vol 14 Figure 11.6.1 (see separate volume of figures).

11.3.17 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.

11.3.18 The assessment area, defined using the methodology provided in Vol 2 Section 11, is indicated in Vol 14 Figure 11.4.4 for townscape and Vol 14 Figure 11.4.5 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 upstream of the site where the proposed development would be obscured by Grosvenor Bridge and downstream of the site with the proposed development would be obscured by Vauxhall Bridge. The visual assessment area has similarly been set by the maximum extent of the operational phase ZTV, except in those locations upstream of the site where the proposed development would be obscured by Grosvenor Bridge and downstream of the site with the proposed development would be obscured by Vauxhall Bridge. All visual assessment viewpoints are located within the ZTV.

11.3.19 The operational assessment area for this site intersects with the assessment areas for the proposed Thames Tideway Tunnel project sites at Heathwall Pumping Station and Albert Embankment Foreshore, therefore likely significant effects on receptors arising from the proposed development at all of these sites are included in this assessment.

11.3.20 In terms of the operational base case for the assessment of effects on Kirtling Street, it is assumed that in addition to the base case schemes identified for the construction phase, the following developments identified within the site development schedule (Vol 14 Appendix N), of relevance to the townscape and visual assessment within the assessment area would be complete and occupied by Year 1 of operation:

a. phases 1, 2, 3 and 4, parts of phase 5 and phase 6 of the Battersea Power Station redevelopment, comprising the mixed plots to the southeast of the power station

b. buildings B1, B2, B3, B4, B5 and B6 and the site entrance of the New Covent Garden Market development, comprising mixed use plots to the north of the development adjacent to Nine Elms Lane

c. all plots in the Embassy Gardens development

d. plots A, B, C and D of the Post Office Depot mixed use redevelopment, comprising plots to the west of the development

e. Vauxhall Square development

f. plots A, B, C and D of the Nine Elms Parkside development.

11.3.21 For the purposes of the Year 15 assessment, it is assumed that all of the above developments would be fully complete and occupied by Year 15 of operation.

11.3.22 There are no schemes identified in the site development schedule which are of relevance to the assessment of cumulative effects for the townscape and visual topic on the basis that the Thames Tideway Tunnel project alone would have beneficial effects during operation, and there would therefore be no cumulative effect with any non Thames Tideway Tunnel project schemes which would be under construction during Year 1 of operation (e.g. later phases of the Post Office Depot development). Therefore, no assessment of cumulative effects has been undertaken for Kirtling Street in the operational phase.

11.3.23 As with construction (para. 11.3.14), the assessment of operational effects also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Assumptions and limitations

11.3.24 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 11. Site specific assumptions and limitations are detailed below.

Assumptions

11.3.25 For the purposes of the construction phase assessment, it is assumed that the construction activities and plant, noise shed, site hoardings, welfare facilities and access points are in the location shown on the Construction phase 2 (tunnelling) plan (see separate volume of figures – Section 1). 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 Construction phase plans in separate volume of figures – Section 1), with the permanent structures under construction located within the zones shown on Site works parameter plan (see separate volume of figures – Section 1).

11.3.26 For the purposes of the operational phase assessment, it is assumed that the above ground structures are in the location shown on the Proposed landscape plan (see separate volume of figures – Section 1). 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 Site works parameter plan, see separate volume of figures – Section 1).

Limitations

11.3.27 The assumed completion of the Riverlight development adjacent to the site in the construction phase base case would introduce additional visual receptors. Effects on these receptors are assessed with reference to viewpoint 1.8. Due to suitable representative publicly accessible locations for this viewpoint not being available at present, no photos have been included from this location and the assessment has been undertaken based on professional judgement.

11.3.28 Despite the limitations identified above, the assessment is considered robust.

11.4 Baseline conditions

11.4.1 The following section sets out the baseline conditions for the townscape and visual assessment within and around the site as follows:

a. Information on the physical elements that make up the overall townscape character of the assessment area (topography, land use, development patterns, vegetation, open space and transport routes), which inform the identification of townscape character areas. These form the receptors for the townscape assessment.

b. Information on the townscape character (including setting), condition, tranquillity, value and sensitivity of the site and each townscape character area.

c. Information on the nature of the existing views towards the site from all visual assessment viewpoints, during both daytime and night time and in 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 on the south bank of the river Thames, with no notable topographic features in the wider assessment area.

Land use

11.4.4 In the vicinity of the site, the south bank of the river is characterised by commercial and industrial uses located between the river and the railway line between Queensland Road and London Waterloo mainline stations, with the exception of the extensive St George's Wharf residential development south of Vauxhall Bridge. There are also large areas of disused land, some of which are planned to be redeveloped (as described in para. 11.3.12).

11.4.5 On the north bank of the river, land use is predominantly residential apart from some educational, leisure and tourism related uses.

Development patterns and scale

11.4.6 Vol 14 Figure 11.4.1 (see separate volume of figures) illustrates the pattern and scale of development and building heights within the assessment area.

11.4.7 Within the assessment area, the south bank river frontage is characterised by dense blocks of buildings with large footprints, many of which are above 40m high. Industrial buildings form a large area of enclosed and inward looking development with closed façades.

11.4.8 On the north bank of the river, opposite the site, residential properties are arranged in a grid formation, dominated by two to four storey terraces with intermittent high-rise developments.

Vegetation patterns and extents

11.4.9 Vol 14 Figure 11.4.2 (see separate volume of figures) illustrates the pattern and extent of vegetation, including tree cover, within the assessment area.

11.4.10 South of the river, street trees are uncommon within the assessment area, with the exception of the river frontage. Vegetation on the southern bank is largely associated with disused plots of land which have been largely unmaintained.

11.4.11 Street trees are a more important element of the character of the townscape on the northern bank, with numerous roads densely planted with mature avenues. Mature tree planting is also a key characteristic of the public and private open spaces throughout the area.

11.4.12 A number of trees in the assessment area are protected by Tree Preservation Orders (TPOs), and trees on both sides of the river are protected by conservation area status.

Open space distribution and type

11.4.13 The assessment area south of the river is characterised by a notable absence of spaces, apart from a small number of spaces alongside the Thames Path to the east of the site. The Thames Path itself is designated as a Green Chain.

Transport routes

11.4.14 Vol 14 Figure 11.4.3 (separate volume) illustrates the transport network within the assessment area, including cycleways, footpaths and Public Rights of Way.

11.4.15 The site is located to the north of Nine Elms Lane, which is characterised by high levels of traffic. The wider area on the south bank of the river is dominated by transport infrastructure, including the railway line running east-west, connecting Clapham Junction and Vauxhall/London Waterloo mainline stations, and the railway running north-south, connecting Clapham Junction and Victoria mainline stations.

11.4.16 The north bank of the river is characterised by Grosvenor Road running along the river frontage, dominated by relatively heavy traffic. The remainder of the area is predominantly characterised by quiet residential streets.

11.4.17 On the north bank, the Thames Path runs along the riverside. To the south, the Thames Path partially runs along the river frontage, but is diverted inland around St George’s Wharf residential development to the east of the site, and the Battersea Power Station industrial area to the west. The Thames Path is also locally diverted around the site at present.

Site character assessment

11.4.18 The majority of the site is located on land, across a series of existing industrial premises between the riverfront and Nine Elms Lane, including a concrete batching works. The site also comprises an area on the river that would allow a jetty to be built for the construction phase. The site area is dominated by existing industrial buildings and hardstanding, and has little vegetation cover or public amenity.

11.4.19 The river is characterised by a wide area of foreshore in the site boundary.

11.4.20 The character of the site is illustrated by Vol 14 Plate 11.4.1 and the components of the site are described in more detail in Vol 14 Table 11.4.1.

Vol 14 Plate 11.4.1 The character of the site

Date taken: 18 August 2011. 18mm lens.

Vol 14 Table 11.4.1 Townscape – site components

ID	Component	Description	Condition
01	River wall	Sheet piled wall.	Poor condition
02	Trees and shrubs	Linear band of formal planting along Nine Elms Lane at the southern edge of the site.	Fair condition
03	Warehouses	Industrial warehousing unit located adjacent to the river at the northern end of the site.	Poor condition
04	Depot	Commercial depot with a large area of hardstanding, located in the centre of the site.	Poor condition
05	Former petrol station	Former petrol station located towards the centre of the site.	Poor condition
06	Commercial premises	Small scale office buildings along Nine Elms Lane at the southern end of the site.	Poor condition
07	Concrete batching works	Industrial area fronting onto the river, including storage areas, hardstanding, a concrete batching works, overhead conveyor and electricity substation. The works are located on a safeguarded wharf.	Poor condition

11.4.21 The condition of the townscape within the site is poor, due to the industrial and commercial use of the site, some of which is disused.

11.4.22 The industrial use of the site, set amongst the wider industrial area and adjacent to the busy Nine Elms Lane, means the site has a low level of tranquillity.

11.4.23 The site has limited townscape value due to the lack of open space and the industrial use of the area.

11.4.24 Due to the poor condition and limited townscape value, the site has a low sensitivity to change.

Townscape character assessment

11.4.25 The townscape character areas surrounding the site are identified in Vol 14 Figure 11.4.4 (see separate volume of figures). Townscape character areas are ordered beginning with the river reach, then to the north of the site and continuing around the site in a clockwise direction. Each area is described below.

River Thames – Nine Elms Reach TCA

11.4.26 This reach of the river extends from Chelsea Bridge in the west to Vauxhall Bridge in the east. The reach is largely characterised by a mix of residential development and industrial, commercial and disused frontages, many of which are planned for redevelopment. The character of this area is illustrated by Vol 14 Plate 11.4.2.

Vol 14 Plate 11.4.2 River Thames – Nine Elms Reach TCA

Date taken: 2 August 2011. 18mm lens.

11.4.27 The river itself, within the assessment area, is characterised by a varying frontage with different river wall characters and numerous piers, jetties and small inlets. Both banks have a relatively wide area of foreshore at low tide.

11.4.28 The river walls and structures are well maintained. The overall townscape condition is fair.

11.4.29 Despite the residential character along parts of the river frontage, the presence of heavy industries in the immediate area, in turn generating industrial river transport, means the reach has a moderate level of tranquillity.

11.4.30 The reach is a regionally valued stretch of the river, forming the backdrop to a number of conservation areas on the north side of the river, in addition to the high profile regeneration of Battersea Power Station.

11.4.31 Due to the fair condition and moderate levels of tranquillity, this character area has a medium sensitivity to change.

Nine Elms Lane Residential TCA

11.4.32 This character area comprises a narrow band of residential apartments along the riverfront, bounded to the south by Nine Elms Lane and the industrial and commercial units further inland. The residential buildings are brick built and are seven to nine storeys high. The Thames Path runs along the river, connecting small areas of public open space at either end of the area, characterised by amenity grassland and scattered mature and semi-mature trees. The character of this area is illustrated by Vol 14 Plate 11.4.3.

Vol 14 Plate 11.4.3 Nine Elms Lane Residential TCA

Date taken: 2 August 2011. 18mm lens.

11.4.33 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.34 Tranquillity within the area is limited by pedestrian movements along the riverside path and the presence of Nine Elms Lane, although this is partially moderated by the presence of green open spaces and the residential character. Therefore, the area has moderate levels of tranquillity.

11.4.35 The area is likely to be locally valued by residents within the character area, but has limited value in the wider area.

11.4.36 Due to the good condition and local value of the townscape, and the moderate levels of tranquillity, this area has a medium sensitivity to change.

St George's Wharf Residential TCA

11.4.37 St George's Wharf is characterised by a recent residential development comprising five 22 storey towers orientated towards the river and set amongst extensive semi-private open space. The character area also incorporates Market Towers, a 23 storey commercial tower. Part of the area is currently undergoing redevelopment with the construction of a residential tower. The character of this area is illustrated by Vol 14 Plate 11.4.4.

Vol 14 Plate 11.4.4 St Georges Wharf TCA

Date taken: 2 August 2011. 18mm lens.

11.4.38 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.39 The area has moderate levels of tranquillity by virtue of the residential character and density of open space amongst the residential blocks, slightly moderated by the presence of the busy Nine Elms Lane running through the character area.

11.4.40 The high rise riverfront development is likely to be locally valued by the residents that live there. Due to the good condition, moderate levels of tranquillity and local value of the townscape, this area has a medium sensitivity to change.

Nine Elms Lane Commercial TCA

11.4.41 This character area is dominated by commercial and industrial uses focused around the railway line between Clapham Junction, Vauxhall and London Waterloo mainline stations. Commercial premises are four to five storeys high, with the exception of one 16 storey high-rise office. Industrial units, further south are one to three storeys high. The railway arches also incorporate small mixed industrial and commercial uses. The area is characterised by a lack of public open space, with spaces between buildings typically hard surfaced and used for car parking or storage. There are few mature or semi-mature trees present in the area. The pattern of development is focused around the railway and is enclosed and segregated from the river by residential uses. Buildings include the Royal Mail depot and Flower Market. The character of this area is illustrated by Vol 14 Plate 11.4.5.

Vol 14 Plate 11.4.5 Nine Elms Lane Commercial TCA

Date taken: 2 August 2011. 31mm lens.

11.4.42 The buildings and public realm within the area are relatively poorly maintained. The overall townscape condition is poor.

11.4.43 Tranquillity within the area is limited by high levels of vehicular traffic, the presence of the busy railway line, lack of street trees and open spaces, and the commercial land uses.

11.4.44 The area has limited townscape value by virtue of the poor condition of the public realm and the commercial land use.

11.4.45 Due to the poor condition and limited value of the area, this character area has a low sensitivity to change.

Battersea Industrial TCA

11.4.46 This character area is dominated by commercial and industrial uses, and brownfield land focused around the Grade II listed Battersea Power Station. The area comprises a large area of open hardstanding around the power station, a waste transfer station and cement factory on the riverfront and a series of low lying commercial warehouses, depots and offices. Tideway Industrial Estate, adjacent to the site, is characterised by ongoing construction activity. The character of this area is illustrated by Vol 14 Plate 11.4.6.

Vol 14 Plate 11.4.6 Battersea Industrial TCA

Date taken: 15 August 2011. 18mm lens.

11.4.47 A baseline description of the Grade II* listed Battersea Power Station as a heritage asset is provided in Section 7.4 of this volume.

11.4.48 The buildings and public realm within the area are relatively poorly maintained. The overall townscape condition is poor.

11.4.49 Tranquillity within the area is limited by high levels of vehicular traffic, the presence of the busy railway line, a lack of street trees and open spaces, and the commercial land uses.

11.4.50 The area has limited townscape value by virtue of the poor condition of the public realm and the commercial land use. However, Battersea Power Station represents a component of the character area that is regionally valued by virtue of its contribution to London’s skyline.

11.4.51 Due to the poor condition and overall limited value of the area, this character area has a low sensitivity to change.

Pimlico Residential TCA

11.4.52 This area is dominated by residential uses and incorporates the following conservation areas:

a. Pimlico Conservation Area

b. Churchill Gardens Conservation Area

c. Dolphin Square Conservation Area.

11.4.53 The character of the area is dominated by residential terraces aligned in a grid formation, although there are also parades of small retail units, churches (including the Grade I listed St James-the-Less) and some leisure uses. Churchill Gardens and Dolphin Square Conservation Areas each form enclosed residential estates, with small areas of public and private open space. There is a general abundance of mature street trees and dense vegetation in open spaces, providing a green character to the area. The development pattern comprises a mix of large blocks up to around nine to eleven storeys, set amongst terraces of two to four storey properties. The area is largely enclosed in character. The character of this area is illustrated by Vol 14 Plate 11.4.7.

Vol 14 Plate 11.4.7 Pimlico Residential TCA

Date taken: 2 August 2011. 18mm lens.

11.4.54 A baseline description of Churchill Gardens, Dolphin Square and Pimlico Conservation Areas as heritage assets is provided in Section 7.4 of this volume.

11.4.55 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.56 Despite the presence of some busy roads through the area, the townscape has moderate levels of tranquillity due to the residential character and the enclosed nature of the area.

11.4.57 The townscape of the character area is valued at the borough level, by virtue of the conservation area designations.

11.4.58 Therefore, because of the borough level 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.

Visual baseline

11.4.59 Vol 14 Figure 11.4.5 (see separate volume of figures) indicates the location of viewpoints referenced below. All residential and recreational receptors have a high sensitivity to change, and transport receptors have a medium sensitivity to change. For each viewpoint, the first part of the baseline description relates to the view during winter, the second part relates to the summer view for viewpoints considered in the operational assessment, and the final part relates to the view at night time. Night time descriptions are only provided for views towards the Kirtling Street site, as construction lighting is not considered to give rise to significant effects at Heathwall Pumping Station (refer to Vol 15), Albert Embankment Foreshore (refer to Vol 16) or Chelsea Embankment Foreshore (refer to Vol 13).

Residential

11.4.60 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 and northeast from residences on Grosvenor Road opposite St George's Square

11.4.61 This viewpoint is representative of the oblique view from residential properties adjacent to the Thames Path on the north bank of the river, on Grosvenor Road opposite St George's Square.

Vol 14 Plate 11.4.8 Viewpoint 1.1: winter view towards Kirtling Street and Heathwall Pumping Station (southwest)

Date taken: 9 December 2011. 18mm lens.

11.4.62 The view (illustrated in Vol 14 Plate 11.4.8) is an open panorama across the river towards Battersea Power Station (far right of the view illustrated). The view is characterised by industrial buildings along the south bank of the river. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Kirtling Street and Heathwall Pumping Station sites from this viewpoint are partially obscured by an existing pier in the foreground of the view.

11.4.63 At night, the view across the river is largely unlit. The view of the opposite river bank is characterised by light spill from buildings along the frontage, including wider residential premises. The frontage of the Kirtling Street site is largely unlit.

Vol 14 Plate 11.4.9 Viewpoint 1.1: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 15 February 2012. 50mm lens.

11.4.64 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.11). The view (illustrated in Vol 14 Plate 11.4.9) is an open panorama over the river, focused towards the St George's Wharf development and Vauxhall Bridge, which form dominant components of the background of the view. Views of the Albert Embankment Foreshore site are largely obscured by Vauxhall Bridge, apart from the part of the site to the west of the bridge which is directly visible.

Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place

11.4.65 This viewpoint is representative of the oblique view from residential properties adjacent to the Thames Path on the north bank of the river, on Grosvenor Road, near Balvaird Place.

Vol 14 Plate 11.4.10 Viewpoint 1.2: winter view towards Kirtling Street and Heathwall Pumping Station (southwest)

Date taken: 9 December 2011. 35mm lens.

11.4.66 The view (illustrated in Vol 14 Plate 11.4.10) is an open panorama over the river towards Battersea Power Station (just beyond the field of view illustrated). The view is characterised by industrial buildings along the south bank of the river, in addition to residential premises along Nine Elms Lane in the foreground of the view (far left of the image). The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Kirtling Street and Heathwall Pumping Station and sites, partially located on the foreshore, are unobstructed from this viewpoint.

11.4.67 At night, the view across the river is largely unlit. The view of the opposite river bank is characterised by light spill from buildings along the frontage, including wider residential properties. The frontage of the Kirtling Street site is largely unlit.

Vol 14 Plate 11.4.11 Viewpoint 1.2: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 9 December 2011. 35mm lens.

11.4.68 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.11). The view (illustrated in Vol 14 Plate 11.4.11) is an open panorama over the river, focused towards the St George's Wharf development and Vauxhall Bridge, which form dominant components of the background of the view. Views of the Albert Embankment Foreshore site are largely obscured by Vauxhall Bridge, apart from the part of the site to the west of the bridge which is directly visible.

Viewpoint 1.3: View southwest and northeast from residences along Nine Elms Lane

11.4.69 This viewpoint is representative of the oblique view from residences between the Thames Path and Nine Elms Lane.

Vol 14 Plate 11.4.12 Viewpoint 1.3: winter view towards Kirtling Street and Heathwall Pumping Station (southwest)

Date taken: 9 December 2011. 35mm lens.

11.4.70 The linear view (illustrated in Vol 14 Plate 11.4.12) up the river is focused on Battersea Power Station in the middle ground of the view, which dominates the skyline. The remainder of the view is characterised by commercial and residential premises along the southern bank of the river. Views of the parts of the Kirtling Street and Heathwall Pumping Station sites located on the foreshore are visible from this location.

11.4.71 At night, the view along the southern bank is lit by pedestrian lighting and light spill from residential and commercial properties. The frontage of the Kirtling Street site is largely unlit.

Vol 14 Plate 11.4.13 Viewpoint 1.3: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 21 November 2011. 18mm lens.

11.4.72 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.11). The linear view (illustrated in Vol 14 Plate 11.4.13) down the river is characterised by residential and commercial premises along the southern bank, including residences along Nine Elms Lane in the foreground, the St George's Wharf development in the middle ground and Camelford House in the background, adjacent to the Albert Embankment Foreshore site. Vauxhall Bridge forms a key component of the background of the view, which largely obscures views of the Albert Embankment Foreshore site.

Viewpoint 1.4: View southwest from residences along Nine Elms Lane close to Heathwall pumping station

11.4.73 This viewpoint is representative of the oblique view from residences between the Thames Path and Nine Elms Lane.

Vol 14 Plate 11.4.14 Viewpoint 1.4: winter view towards Kirtling Street and Heathwall Pumping Station

Date taken: 9 December 2011. 35mm lens.

11.4.74 The linear view (illustrated in Vol 14 Plate 11.4.14) up the river is focused on Battersea Power Station, which dominates the skyline in the middle ground of the view. The foreground of the view is characterised by the Thames Path in front of residences along Nine Elms Lane, and commercial premises along the river frontage, including Heathwall Pumping Station. Grosvenor Bridge forms the background to the view. Views of the parts of the sites located on the foreshore are visible from this location.

11.4.75 At night, the view along the southern bank is lit by pedestrian lighting and light spill from residential and commercial properties. The frontage of the Kirtling Street site is largely unlit.

Viewpoint 1.5 View northeast from residences along Battersea Park Road

11.4.76 This viewpoint is representative of the typical view from residences at the junction of Battersea Park Road and Sleaford Street.

Vol 14 Plate 11.4.15 Viewpoint 1.5: winter view towards Kirtling Street and Heathwall Pumping Station

Date taken: 9 December 2011. 18mm lens.

11.4.77 The linear view (illustrated in Vol 14 Plate 11.4.15) along Nine Elms Lane is bounded to the north and south by industrial and commercial premises which line the road. Existing buildings within the southern extent of the Kirtling Street site are visible in the foreground of the view which obscure wider views of this site.

11.4.78 The wall surrounding Heathwall pumping station and Middle Wharf is visible in the background of the view (obscured by traffic in the image shown). Views of the majority of the Heathwall Pumping Station site are largely obscured from this location by the existing pumping station and boundary walls.

11.4.79 At night, the view is brightly lit by foreground street lighting, heavy traffic and light spill from surrounding buildings.

Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace

11.4.80 This viewpoint is representative of the oblique view from residences along Grosvenor Road, close to Telford Terrace on the north bank of the river.

Vol 14 Plate 11.4.16 Viewpoint 1.6: winter view towards Kirtling Street and Heathwall Pumping Station

Date taken: 9 December 2011. 18mm lens.

11.4.81 The foreground of the view (illustrated in Vol 14 Plate 11.4.16) is characterised by the area of public realm and mature tree planting adjacent to the river. Battersea Power Station forms the dominant skyline feature in the background of the view, on the opposite side of the river. The remainder of the view across the river incorporates industrial and commercial premises along the frontage, including Heathwall pumping station. Views of the sites, partially located on the foreshore, are partially screened by foreground vegetation.

11.4.82 At night, the foreground of the view is lit by light spill from adjacent buildings and street lighting along the river frontage. The view of the opposite river bank is lit by light spill from commercial properties and operations.

Viewpoint 1.7: View south and southeast from residences along Grosvenor Road, close to Churchill Gardens Estate

11.4.83 This viewpoint is representative of the typical view from residential properties adjacent to the Thames Path on the north bank of the river, on Grosvenor Road opposite Claverton Street.

Vol 14 Plate 11.4.17 Viewpoint 1.7: winter view towards Kirtling Street (south)

Date taken: 6 May 2011. 18mm lens.

11.4.84 The view towards Kirtling Street (illustrated in Vol 14 Plate 11.4.17) is characterised by industrial and commercial premises along the river. Views of the river frontage of the Kirtling Street site are unobstructed from this viewpoint. Inland views of the site are largely obscured by intervening buildings.

Vol 14 Plate 11.4.18 Viewpoint 1.7: summer view towards Kirtling Street (south)

Date taken: 8 August 2012. 18mm lens.

11.4.85 In summer, the view towards the Kirtling Street site (illustrated in Vol 14 Plate 11.4.18) is largely unchanged.

11.4.86 At night, the view across the river is largely unlit. The view of the opposite river bank is characterised by light spill from buildings along the frontage, including residential and commercial premises. The frontage of the Kirtling Street site is largely unlit.

Vol 14 Plate 11.4.19 Viewpoint 1.7: winter view towards Heathwall Pumping Station (southeast)

Date taken: 9 December 2011. 35mm lens.

11.4.87 The view towards Heathwall Pumping Station (illustrated in Vol 14 Plate 11.4.19) is across the river, focused on residential, commercial and industrial premises along the river frontage. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Heathwall Pumping Station site, largely located on the foreshore, are unobstructed from this viewpoint.

Vol 14 Plate 11.4.20 Viewpoint 1.7: summer view towards Heathwall Pumping Station (southeast)

Date taken: 22 August 2011. 35mm lens.

11.4.88 In summer, the view towards the Heathwall Pumping Station site (illustrated in Vol 14 Plate 11.4.20) is largely unchanged.

Viewpoint 1.8: View west from newly built residences in the Riverlight development (base case scheme)

11.4.89 This viewpoint is representative of the typical view for residents of new residential blocks adjacent to the site which are anticipated to be complete in advance of the proposed construction at Kirtling Street commencing. The view at present is dominated by industrial units within the Kirtling Street site, with the Cemex works and waste transfer station visible beyond. Views of the whole site would be unobstructed from this location, particularly from upper storeys in the new development. Due to the viewpoint not being publically accessible at present, no photo has been included from this location.

11.4.90 In summer, the views towards the site would be largely unchanged.

11.4.91 At night, the view would be characterised by relatively high levels of light from surrounding buildings and street lighting.

Recreational

11.4.92 Recreational receptors (apart from those engaged in active sports) generally 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 southwest from the northern end of Vauxhall Bridge

11.4.93 This viewpoint is representative of the typical view from pedestrians crossing Vauxhall Bridge, towards the northern end of the bridge.

Vol 14 Plate 11.4.21 Viewpoint 2.1: winter view towards Kirtling Street and Heathwall Pumping Station

Date taken: 9 December 2011 year. 35mm lens.

11.4.94 The linear view (illustrated in Vol 14 Plate 11.4.21) up the river towards Battersea Power Station to the west is characterised by industrial buildings along the south bank of the river, alongside residences along Nine Elms Lane. Residential premises along the frontage of the north bank form the foreground of the view. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the sites, partially located on the foreshore, are unobstructed from this viewpoint.

11.4.95 At night, the view across the river is largely unlit. The view of the opposite river bank is characterised by light spill from buildings along the frontage, including residential and commercial premises. The frontage of the Kirtling Street site is largely unlit.

Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge

11.4.96 This viewpoint is representative of the typical view from pedestrians crossing Vauxhall Bridge, from the centre of the bridge.

Vol 14 Plate 11.4.22 Viewpoint 2.2: winter view towards Kirtling Street and Heathwall Pumping Station

Date taken: 9 December 2011. 35mm lens.

11.4.97 The linear view (illustrated in Vol 14 Plate 11.4.22) up the river towards Battersea Power Station is characterised by industrial buildings along the south bank of the river, and residences along Nine Elms Lane. The existing Heathwall pumping station is visible, set amongst other industrial buildings similar in character. Views of the sites, partially located on the foreshore, are unobstructed from this viewpoint.

11.4.98 At night, the view across the river is largely unlit. The view of the opposite river bank is characterised by light spill from buildings along the frontage, including residential and commercial premises. The frontage of the Kirtling Street site is largely unlit.

Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

11.4.99 This viewpoint is representative of the typical view from pedestrians crossing Vauxhall Bridge, towards the southern end of the bridge.

Vol 14 Plate 11.4.23 Viewpoint 2.3: winter view towards Kirtling Street and Heathwall Pumping Station

Date taken: 9 December 2011. 35mm lens.

11.4.100 The linear view (illustrated in Vol 14 Plate 11.4.23) up the river towards Battersea Power Station is characterised by industrial buildings along the south bank of the river and residences along Nine Elms Lane. The power station forms a key component of the background of the view, dominating the skyline. The existing Heathwall pumping station is visible set amongst other industrial buildings that are similar in character. Views of the sites, partially located on the foreshore, are partially obstructed by a foreground river pier.

11.4.101 At night, the view across the river is largely unlit. The view of the opposite river bank is characterised by light spill from buildings along the frontage, including residential and commercial premises. The frontage of the Kirtling Street site is largely unlit.

Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development

11.4.102 This viewpoint is representative of the typical view for recreational users of the Thames Path and open spaces in front of the St George's Wharf residential development.

Vol 14 Plate 11.4.24 Viewpoint 2.4: winter view towards Kirtling Street and Heathwall Pumping Station (southwest)

Date taken: 9 December 2011. 35mm lens.

11.4.103 The view (illustrated in Vol 14 Plate 11.4.24) is an open panorama over the river, focused on Battersea Power Station in the background. The view is also focused on residential properties along Nine Elms Lane which are set beyond the foreground of the river frontage of St George's Wharf. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Kirtling Street and Heathwall Pumping Station sites are partially obscured, although views of the foreshore parts of the sites are largely unobstructed.

11.4.104 At night, the view along the southern bank is lit by pedestrian lighting and light spill from residential and commercial properties, including in the foreground of the view. The frontage of the Kirtling Street site is largely unlit.

Vol 14 Plate 11.4.25 Viewpoint 2.4: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 21 November 2011. 18mm lens.

11.4.105 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.11). The view (illustrated in Vol 14 Plate 11.4.25) is characterised by an open panorama over the river towards Vauxhall Bridge, visible in the middle ground of the view. The view towards the Albert Embankment Foreshore site is framed by the St George's Wharf development, Vauxhall Cross building and Camelford House. Views towards the site are largely obscured by Vauxhall Bridge.

Viewpoint 2.5: View east from the southern end of Chelsea Bridge

11.4.106 This viewpoint is representative of the typical view from pedestrians crossing Chelsea Bridge, towards the southern end of the bridge.

Vol 14 Plate 11.4.26 Viewpoint 2.5: winter view

Date taken: 9 December 2011. 18mm lens.

11.4.107 The view down the river (illustrated in Vol 14 Plate 11.4.26) is dominated by the adjacent Grosvenor Bridge, which largely obscures views towards the site.

11.4.108 At night, the foreground of the view is brightly lit by street lighting along the bridge, public realm lighting along the southern bank and high levels of light spill from buildings along the southern bank.

Viewpoint 2.6: View southeast from the northern end of Chelsea Bridge

11.4.109 This viewpoint is representative of the typical view from pedestrians crossing Chelsea Bridge, towards the northern end of the bridge.

Vol 14 Plate 11.4.27 Viewpoint 2.6: winter view

Date taken: 9 December 2011. 18mm lens.

11.4.110 The view down the river (illustrated in Vol 14 Plate 11.4.27) is dominated by the adjacent Grosvenor Bridge, which largely obscures views towards the site. Battersea Power Station forms a dominant component of the view.

11.4.111 At night, the view across the river is largely unlit. The view of the opposite river bank is largely obscured by Grosvenor Bridge, but is characterised by high levels of light spill from buildings along the southern bank.

Viewpoint 2.7: View southeast and west from the Thames Path opposite the King William IV public

11.4.112 This viewpoint is representative of the typical view from recreational users of the Thames Path on the north bank of the river opposite Lupus Street.

Vol 14 Plate 11.4.28 Viewpoint 2.7: winter view towards Kirtling Street and Heathwall Pumping Station (southeast)

Date taken: 15 February 2012. 18mm lens.

11.4.113 The view (illustrated in Vol 14 Plate 11.4.28) is an open panorama over the river, focused on industrial and commercial premises along the south bank of the river, including Heathwall pumping station. Views of the Kirtling Street and Heathwall Pumping Station sites, partially located on the foreshore, are unobstructed from this location.

11.4.114 At night, the view across the river is largely unlit. The view of the opposite river bank is characterised by light spill from buildings along the frontage, including residential and commercial premises. The frontage of the Kirtling Street site is largely unlit.

Vol 14 Plate 11.4.29 Viewpoint 2.7: winter view towards Chelsea Embankment Foreshore (west)

Date taken: 5 January 2012. 18mm lens.

11.4.115 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Chelsea Embankment Foreshore (refer to para. 11.3.11). The foreground of the view (illustrated in Vol 14 Plate 11.4.29) is dominated by Grosvenor Road and the avenue of mature London plane trees along the river frontage. Grosvenor Bridge is visible in the background of the view, largely obscuring views towards the Chelsea Embankment Foreshore site.

Transport

11.4.116 Travel through an area is often the means by which the greatest numbers of people view the townscape. Such receptors generally have a medium sensitivity to change.

Viewpoint 3.1: View west and northeast from the westbound carriageway of Nine Elms Lane

11.4.117 This viewpoint is representative of the typical view from people travelling west towards the site along Nine Elms Lane.

Vol 14 Plate 11.4.30 Viewpoint 3.1: winter view towards Kirtling Street (west)

Date taken: 9 December 2011. 18mm lens.

11.4.118 The linear view (illustrated in Vol 14 Plate 11.4.30) along Nine Elms Lane is contained on both sides by industrial and commercial premises and hoardings on the boundary of the Riverlight development site. The southern extent of the Kirtling Street site is highly visible in the foreground of the view. There are also glimpsed views through to the site between industrial buildings on Cringle Street and Tideway Walk.

11.4.119 During summer, the view towards the site is unchanged due to the lack of vegetation within the view. Therefore, no photo is included during summer.

11.4.120 At night, the foreground of the view is brightly lit by street lighting, heavy traffic along Nine Elms Lane and light spill from surrounding buildings.

Vol 14 Plate 11.4.31 Viewpoint 3.1: winter view towards Heathwall Pumping Station (northeast)

Date taken: 25 January 2012. 18mm lens.

11.4.121 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Heathwall Pumping Station. The linear view (illustrated in Vol 14 Plate 11.4.31) along Nine Elms Lane is contained on both sides by industrial and commercial premises and hoardings to the Riverlight development site. The boundary wall to Middle Wharf and Heathwall pumping station forms part of the background to the view, obscuring views to the remainder of the Heathwall Pumping Station site.

11.4.122 During summer, the view towards the site is unchanged due to the lack of vegetation within the view. Therefore, no photo is included during summer.

Viewpoint 3.2: View north from Nine Elms Lane at the junction with Market Entrance

11.4.123 This viewpoint is representative of the typical view from people travelling along Nine Elms Lane.

Vol 14 Plate 11.4.32 Viewpoint 3.2: winter view

Date taken: 9 December 2011. 18mm lens.

11.4.124 The linear view (illustrated in Vol 14 Plate 11.4.32) along Nine Elms Lane is contained on both sides by industrial and commercial premises. The southern extent of the site is highly visible in the foreground of the view. Views of the rest of the site are obscured by buildings fronting onto Nine Elms Lane.

Vol 14 Plate 11.4.33 Viewpoint 3.2: summer view

Date taken: 8 August 2012. 18mm lens.

11.4.125 In summer, the view towards the site (illustrated in Vol 14 Plate 11.4.33) is largely unchanged.

11.4.126 At night, the foreground of the view is brightly lit by street lighting, heavy traffic along Nine Elms Lane and light spill from surrounding buildings.

Viewpoint 3.3: View northeast from the eastbound carriageway of Battersea Park Road crossing the railway line

11.4.127 This viewpoint is representative of the typical view from people travelling east towards the site along Battersea Park Road.

Vol 14 Plate 11.4.34 Viewpoint 3.3: winter view

Date taken: 9 December 2011. 35mm lens.

11.4.128 The linear view (illustrated in Vol 14 Plate 11.4.34) along Battersea Park Road is contained to the south (right hand side of the image) by residential properties and small street trees, and to the north (left hand side) by hoardings surrounding the Battersea Power Station site. The southern extent of the site is partially visible in the background of the view. Views of the rest of the site are obscured by intervening buildings and the boundary fencing to Battersea Power Station.

11.4.129 At night, the foreground of the view is brightly lit by street lighting, heavy traffic along Battersea Park Road and light spill from surrounding buildings.

Construction base case

11.4.130 The base case in Site Year 3 of construction taking into account the schemes described in para. 11.3.12 would change the following character areas:

a. River Thames – Nine Elms Reach TCA - By Site Year 2 of construction, the conversion of a number of industrial units and disused plots of land into new residential and mixed use developments would alter the setting of this stretch of the river. However, as there would be no changes to the overall character within the area, the sensitivity would remain medium as described in para. 11.4.31.

b. Nine Elms Lane Commercial TCA – The character of this area would be substantially altered by the assumed completion of the following developments:

   i part of the New Covent Garden Market development ii the US Embassy development, 290m east of the site

iii part of the Embassy Gardens mixed use development

iv Vauxhall Sky Gardens mixed use development

v Vauxhall Tower residential development

vi Market Towers mixed use development.

c. The setting of this area would also be substantially altered, due to the assumed completion of the developments listed within the adjacent Battersea Industrial TCA, described below. The character of the area would be dominated by new high quality residential and mixed uses, as opposed to the existing industrial and commercial character of the area. The area would therefore be likely to have a moderate level of tranquillity and be locally valued by residents within the area, suggesting a medium sensitivity to change.

d. Battersea Industrial TCA – The character of this area would be substantially altered by the assumed completion of the following developments:

i Riverlight residential led mixed use development

ii part of the Battersea Power Station redevelopment

iii the Northern Line Extension.

e. The setting of this area would also be substantially altered, due to the assumed completion of the developments listed within the adjacent Nine Elms Lane Commerical TCA, described below. The character of the area would be dominated by new high quality residential and mixed uses, as opposed to the existing industrial and commercial character of the area. The area would therefore be likely to have a moderate level of tranquillity and be locally valued by residents within the area, suggesting a medium sensitivity to change.

11.4.131 The assumed changes in base case would also alter the nature of the views towards Kirtling Street and Heathwall Pumping Station from the following viewpoints:

a. Viewpoints 1.1, 1.2, 1.6, 1.7, 2.1, 2.2, 2.3, 2.4, 2.7 - Views across the river would encompass a number of the new mixed use developments, altering the character of the views. However, the site, Cemex operations and waste transfer station would still represent industrial/commercial elements of the views.

b. Viewpoints 1.3, 1.4 - The background of views up the river would encompass a number of new mixed use developments, most notably the Riverlight development adjacent to the Kirtling Street site. However, the site, Cemex operations and waste transfer station would still represent industrial/commercial elements of the views.

c. Viewpoint 3.1 – The foreground of the view would be altered by the assumed completion of the Riverlight development, adjacent to the Kirtling Street site. The view, currently characterised by a line of hoardings, would encompass new mixed use blocks with surrounding landscaping.

11.4.132 In addition, the assumed completion of the Riverlight development would introduce additional visual receptors, represented by viewpoint 1.8.

11.4.133 All other receptors would remain as described in the baseline.

Operational base case

11.4.134 In addition to the changes described above during the construction phase, the base case in Year 1 of operation taking into account the schemes described in para. 11.3.20 would further alter the character of Nine Elms Commercial TCA and Battersea Industrial TCA, and the setting of River Thames – Nine Elms Reach TCA through further regeneration of industrial and commercial plots into new mixed use developments. However, it is considered that the sensitivity of the areas would remain medium, as described in para. 11.4.130.

11.4.135 The changes in the base case would also further alter the character of the views from the viewpoints described in para. 11.4.131, although the cemex site and the waste transfer station would remain industrial components of the view on the river frontage.

11.4.136 All other receptors would remain as described in the baseline.

11.5 Construction effects assessment

11.5.1 The following section describes the likely significant effects arising from construction at Kirtling Street taking account of Heathwall Pumping Station, Albert Embankment Foreshore and Chelsea Embankment Foreshore (as detailed in Section 11.3).

11.5.2 Due to the scale of the construction activities proposed across what are, in many cases, prominent locations in London, construction works would be highly visible. In policy terms, the NPS for waste water (Defra, 2012)[6] 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, separate volume of figures – Section 1). Where photomontages have been prepared to assist the assessment of effects, these are referred to in the appropriate viewpoint below.

Site character assessment

11.5.4 Effects on the character of the site would arise from demolition of existing buildings and structures, and construction activity associated with the construction of the shaft and ventilation equipment (standard working hours), and the main tunnel drives and secondary lining (24 hour working). The impacts on specific components of the site are described in Vol 14 Table 11.5.1.

Vol 14 Table 11.5.1 Townscape – impacts on existing site components during construction

ID	Component	Impacts
01	River wall	Affected by construction of jetties and other adjacent construction infrastructure.
02	Trees and shrubs	Vegetation within the site boundary would be cleared prior to construction.
03	Warehouses	Demolished prior to construction.
04	Depot	Demolished prior to construction.
05	Former petrol station	Demolished prior to construction.
06	Commercial premises	Demolished prior to construction.
07	Concrete batching works	Cleared prior to construction. New facilities would be constructed further inland from their existing location. The existing jetty would remain.

11.5.5 The site has a low level of tranquillity, which would be further reduced due to the substantial clearance of buildings and structures required to form the construction site and the level of activity during construction.

11.5.6 Due to the level of clearance required and the intensity of continuous construction activity, the magnitude of change is considered to be high.

11.5.7 The high magnitude of change, assessed alongside the low sensitivity of the site, would result in **minor adverse** effects.

Townscape character areas assessment

River Thames – Nine Elms Reach TCA

11.5.8 The proposed Kirtling Street site is adjacent to this reach of the river, introducing high levels of construction activity into the river including an industrial jetty, construction plant and 24 hour loading of barges (although contiguous with the safeguarded nature of the wharf).

11.5.9 The proposed Heathwall Pumping Station site is also adjacent to this reach of the river, introducing high levels of construction activity within the river corridor, including a temporary cofferdam and intense construction activity. However, the construction activity at both these sites would be similar to other operations in the area such as the waste transfer station adjacent to the Kirtling Street site.

11.5.10 The wider setting of this character area would be affected, although to a limited extent by the construction works at the proposed Albert Embankment Foreshore and Chelsea Embankment Foreshore sites.

11.5.11 The area has a moderate level of tranquillity at present, which would be affected through the introduction of construction activity at these sites, including piling, demolition and river and road based traffic.

11.5.12 Due to construction activity at all four sites, set against an existing presence of industrial activities, the magnitude of change is considered to be medium.

11.5.13 The medium magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

Nine Elms Lane Residential TCA

11.5.14 The wider riverside setting of this area would be affected to a limited extent by construction activity on the river frontage at Kirtling Street, including 24 hour loading of barges, and the cofferdam and construction activity at Albert Embankment Foreshore.

11.5.15 The proposed Heathwall Pumping Station site is set directly west of this character area. The setting of the area would be affected, although to a limited extent by the presence of construction activity, traffic and construction plant. However, the majority of the riverside setting would be largely unaffected.

11.5.16 The area has a moderate level of tranquillity at present, which would be affected through the introduction of construction activity, including piling, demolition and river and road based traffic in the wider area.

11.5.17 Therefore, the magnitude of change arising from the presence of construction activity at all three sites is considered to be medium.

11.5.18 The medium magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

St George's Wharf Residential TCA

11.5.19 The wider setting of this area would be affected, although to a limited extent by construction activity along the river frontage at Kirtling Street, including 24 hour loading of barges.

11.5.20 The proposed Heathwall Pumping Station site also forms part of the wider setting of this character area. The setting would be affected to a limited extent by the presence of construction activity and construction plant.

11.5.21 The proposed Albert Embankment Foreshore site forms part of the immediate setting of this character area, just beyond Vauxhall Bridge. The presence of the temporary cofferdam, construction activity and construction plant at this site would affect the riverside setting of the character area, forming a key component of the setting for the duration of construction.

11.5.22 The area has a moderate level of tranquillity at present, which would be affected through the introduction of construction activity, including piling, demolition and river and road based traffic in the wider area.

11.5.23 Due to the immediate change in setting arising from construction activity at Albert Embankment Foreshore, and the wider changes in setting arising from activities at Kirtling Street and Heathwall Pumping Station, the magnitude of change is considered to be high.

11.5.24 The high magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

Nine Elms Lane Commercial TCA; and Battersea Industrial TCA

11.5.25 The proposed Kirtling Street and Heathwall Pumping Station sites are set directly north of these character areas. The setting of the areas would be affected by the presence of construction activity, construction plant, demolition of existing buildings and structures, 24 hour loading of barges at Kirtling Street and the temporary cofferdam at Heathwall Pumping Station. However, the construction activity at both sites would be set against existing industrial uses, including the waste transfer station and Cemex concrete batching plant immediately west of the Kirtling Street site.

11.5.26 The areas have a moderate level of tranquillity, which would be affected by the intensity of construction activity at Kirtling Street and Heathwall Pumping Station, including demolition, road transport and 24 hour loading of barges.

11.5.27 Due to the intensity of construction at both the Kirtling Street and Heathwall Pumping Station sites, set against the industrial context of the Cemex operations and waste transfer station, the magnitude of change is considered to be medium.

11.5.28 The medium magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **moderate adverse** effects.

11.5.29 The assessment of specific effects on the setting of the Grade II listed Battersea Power Station as a heritage asset is set out in Section 7 of this volume. The historic environment assessment identifies a minor adverse effect on the setting of this asset due to much of the setting being largely unaffected by the proposed development.

Pimlico Residential TCA

11.5.30 The proposed Kirtling Street and Heathwall Pumping Station sites form a direct part of the riverside setting of this character area. The presence of construction activity and a construction plant at both sites, demolition, the river jetty and 24 hour loading of barges at Kirtling Street, and the site cofferdam at Heathwall Pumping Station, would affect the riverside setting of this character area. However, the construction activity would be set against existing industrial uses, including the waste transfer station and

Cemex concrete batching plant immediately west of the Kirtling Street site, which includes industrial barging operations.

11.5.31 The area has a moderate level of tranquillity at present, which would be largely unaffected by construction activities at the sites.

11.5.32 Due to the substantial changes to the immediate riverside setting of this area, set against the presence of other industrial operations, the magnitude of change is considered to be medium.

11.5.33 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, would result in **moderate adverse** effects.

11.5.34 The assessment of specific effects on the setting of Churchill Gardens, Dolphin Square and Pimlico Conservation Areas as heritage assets is set out in Section 7 of this volume. The historic environment assessment identifies minor adverse effects on the setting of these assets due to much of the historic setting being largely unaffected by the proposed development.

Townscape - sensitivity test for programme delay

11.5.35 For the assessment of townscape 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 (paras.11.5.4 to 11.5.33). The Nine Elms Regeneration area is subject to ongoing and long term change and a delay to the Thames Tideway Tunnel project is not likely to change the sensitivity to change of the townscape character already presented (paras. 11.4.2 to 11.4.58).

Visual assessment

11.5.36 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.

Residential

Viewpoint 1.1: View southwest and northeast from residences on Grosvenor Road opposite St George's Square; and Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place

11.5.37 Views towards Kirtling Street and Heathwall Pumping Station sites would be affected by the presence of construction activity, construction plants, welfare facilities, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. The majority of the immediate views across the river would remain unaffected, and the construction would appear alongside other existing industrial uses.

11.5.38 Views from these locations towards the Albert Embankment Foreshore site would be affected by the background visibility of the site cofferdam, construction activity, tall construction plant and welfare facilities, partially obscured by Vauxhall Bridge. The combined sewer overflow (CSO) interception works upstream of the bridge would be directly visible in the middle ground of the views.

11.5.39 Due to the wider visibility of construction activity at all three sites and the direct visibility of the CSO interception works at Albert Embankment Foreshore, the magnitude of change is considered to be medium.

11.5.40 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **moderate adverse** effects.

11.5.41 At night, due to the use of capped and direction lighting (set out in para. 11.2.3), 24 hour lighting at the Kirtling Street would be barely perceptible from these viewpoints. The magnitude of change to these receptors at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 1.3: View southwest and northeast from residences along Nine Elms Lane

11.5.42 The view towards the Kirtling Street and Heathwall Pumping Station sites would be affected by the presence of construction activity, construction plant, the river jetty and 24 hour loading of barges at Kirtling Street and the site cofferdam at Heathwall Pumping Station, in the background of the view. The majority of the wider panoramic view across the river would be largely unaffected.

11.5.43 The wider panoramic views of the river would however be affected by the presence of construction activity and construction plant at the Albert Embankment Foreshore site, although they would be partially obscured by Vauxhall Bridge. CSO interception works would be highly visible set in front of Vauxhall Bridge.

11.5.44 Due to the wider visibility of construction activity at all three sites and the visibility of the interception works at Albert Embankment Foreshore in front of Vauxhall Bridge, the magnitude of change is considered to be medium.

11.5.45 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.46 At night, due to the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character, 24 hour lighting at the Kirtling Street would be barely perceptible from this viewpoint. The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

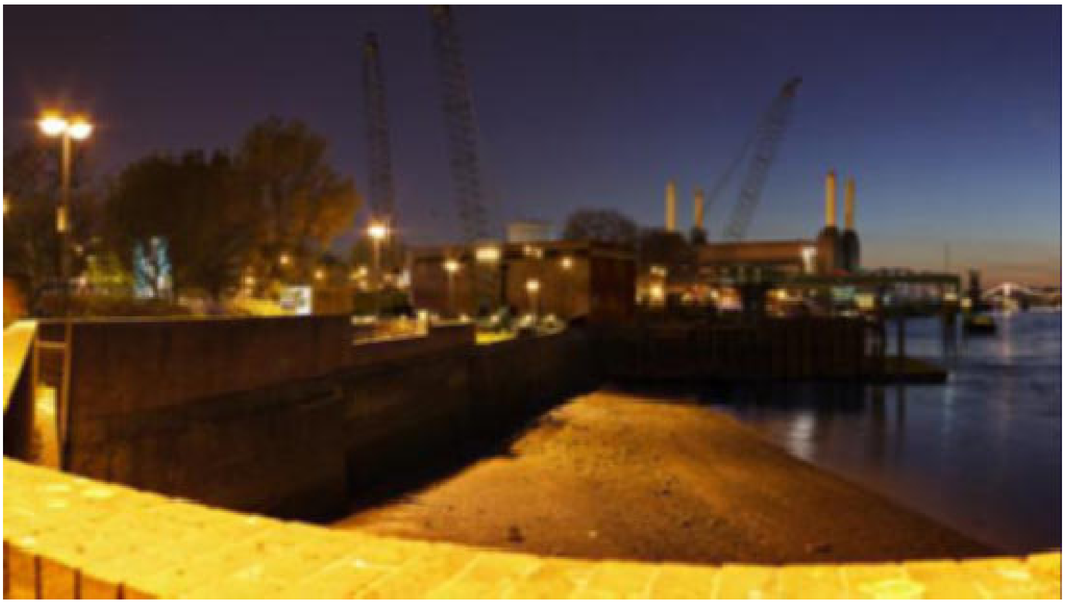
Viewpoint 1.4: View southwest from residences along Nine Elms Lane, close to Heathwall pumping station

11.5.47 Oblique views from residences towards the Kirtling Street and Heathwall Pumping Station sites would be affected during construction. Views along the river would be affected by the foreground presence of the temporary cofferdam, construction activity and construction plant at Heathwall Pumping Station, and the background visibility of the river jetty and 24 hour loading of barges at Kirtling Street. However, the construction activities would be set against existing industrial uses, including the waste transfer station and Cemex concrete batching plant immediately west of the Kirtling Street site, which includes industrial barging operations. Construction activities further inland from the foreshore structures and river frontage, would be obscured by intervening buildings. Therefore, the magnitude of change is considered to be medium.

11.5.48 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.49 At night, due to the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character, 24 hour lighting at the Kirtling Street would be barely perceptible from this viewpoint. The night time view of the proposed development from this viewpoint is illustrated in Vol 14 Plate 11.5.1 below. A larger scale print of the photomontage, including the wider context and annotations is provided in Vol 14 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 2 (tunnelling). The layout of the construction activities may change within the maximum extent of working area (see Construction phase 2 plan – tunnelling in separate volume of figures – Section 1).The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

Vol 14 Plate 11.5.1 Viewpoint 1.4 – illustrative construction phase night time photomontage



Date taken: 7 April 2011. 50mm lens

Viewpoint 1.5: View northeast from residences along Battersea Park Road

11.5.50 Construction activity, tall construction plant, demolition, welfare facilities, site hoardings and road traffic at the southern end of the Kirtling Street site would be visible in the foreground of the view. The construction activity at this site would be set against existing industrial and commercial uses.

11.5.51 Construction activity at the Heathwall Pumping Station site would be barely perceptible from this location, due to the intervening buildings and structures along Nine Elms Lane and mature trees further obscuring the view towards this site.

11.5.52 Therefore, principally due to the visibility of construction activities at the Kirtling Street site, the magnitude of change is considered to be medium.

11.5.53 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.54 At night, lighting at the southern end of the Kirtling Street site would be visible in the foreground of the view along the hoarding line and intermittently within the site. However, due to the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character of the foreground, 24 hour lighting at Kirtling Street would be barely perceptible from this viewpoint. The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace

11.5.55 Views from residences towards the Kirtling Street and Heathwall Pumping Station sites would be affected, although to a limited extent during construction. The panoramic views over the river would be affected by the background presence of construction activity, construction plant, the river jetty and 24 hour loading of barges at Kirtling Street and the site cofferdam at Heathwall Pumping Station. However, the foreground of the view would remain unaffected and wider views towards the site would be partially screened by mature trees along the river frontage. The construction activity would be set against existing industrial uses, including the waste transfer station and Cemex concrete batching plant immediately west of the Kirtling Street site, which includes industrial barging operations. Therefore, the magnitude of change is considered to be low.

11.5.56 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor adverse** effects.

11.5.57 At night, due to the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character, 24 hour lighting at the Kirtling Street would be barely perceptible from this viewpoint. The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 1.7: View southeast and south from residences along Grosvenor Road, close to Churchill Gardens Estate

11.5.58 Views from residences towards the Kirtling Street and Heathwall Pumping Station sites would be affected during construction. The panoramic views over the river would be affected by the presence of construction activity, construction plant, the river jetty and 24 hour loading of barges at Kirtling Street and the site cofferdam at Heathwall Pumping Station. However, the construction activities would be set against existing industrial uses, including the waste transfer station immediately west of the Kirtling Street site, which includes industrial barging operations. The view of the proposed development from this viewpoint is illustrated in Vol 14 Plate

11.5.2 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 15 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 2 (tunnelling). The layout of the construction activities may change within the maximum extent of working area (see Construction phases – phase 2 tunnelling [see separate volume of figures]). Therefore, the magnitude of change is considered to be medium.

Vol 14 Plate 11.5.2 Viewpoint 1.7 – illustrative construction phase photomontage

Date taken: 6 May 2011. 50mm lens

11.5.59 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.60 At night, due to the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character, 24 hour lighting at the Kirtling Street would be barely perceptible from this viewpoint. The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 1.8: View west from newly built residences in the Riverlight development (base case scheme)

11.5.61 Views from new residences towards the site would be affected during construction by the foreground visibility of construction activity, construction plant, welfare facilities and 24 hour loading of barges at the Kirtling Street site. Views from ground level would be characterised by site hoardings, while from upper storeys construction activity across the whole site would be directly visible. Therefore, the magnitude of change is considered to be high.

11.5.62 The high magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **major adverse** effects.

11.5.63 At night, 24 hour lighting across the Kirtling Street site, including continuous loading of barges, would be directly visible in the foreground of the view. However, due to the use of capped and direction lighting (set out in para. 11.2.3) and light spill from surrounding buildings, the magnitude of change to the receptor at night is considered to be medium, resulting in **moderate adverse** effects.

Recreational

Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge; Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge; and Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

11.5.64 Views from these locations up the river would be affected by the background presence of construction activity, construction plant, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. Construction activity inland from the river frontage would be largely obscured at both sites. In addition, the foreground of the views would be unchanged and the overall character of the views would remain largely unaltered, with the construction activity set against other industrial uses, including the waste transfer station and Cemex concrete batching plant adjacent to the Kirtling Street site. Therefore, the magnitude of change is considered to be low.

11.5.65 The low magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **minor adverse** effects.

11.5.66 At night, due to the use of capped and direction lighting (set out in para. 11.2.3), 24 hour lighting at the Kirtling Street would be barely perceptible from these viewpoints. The magnitude of change to these receptors at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development

11.5.67 Views from this location towards the Kirtling Street and Heathwall Pumping Station sites would be affected by the presence of construction activity, construction plant, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. The construction activities would be set against other industrial uses, including the waste transfer station and Cemex concrete batching plant adjacent to the Kirtling Street site.

11.5.68 Wider panoramic views of the river would be affected by the presence of construction activity and construction plant at the Albert Embankment Foreshore site, partially obscured by Vauxhall Bridge. CSO interception works would be highly visible set in front of Vauxhall Bridge in the middle ground of the view. The remainder of the panoramic view across the river would remain unaffected.

11.5.69 Due to the wider visibility of construction activity at all three sites and the direct visibility of the CSO interception works at Albert Embankment Foreshore, the magnitude of change is considered to be medium.

11.5.70 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.71 At night, due to the use of capped and direction lighting (set out in para. 11.2.3), 24 hour lighting at the Kirtling Street would be barely perceptible from this viewpoint. The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 2.5: View east from the southern end of Chelsea Bridge; and Viewpoint 2.6: View southeast from the northern end of Chelsea Bridge

11.5.72 Views from these locations towards the site would be largely obscured by Grosvenor Bridge, residential blocks along Queenstown Road, Battersea Power Station and the waste transfer station at Cringle Dock. Tall construction plant and cranes would be visible in the background of the views. Therefore, the magnitude of change is considered to be negligible.

11.5.73 The negligible magnitude of change, assessed alongside the high sensitivity of these receptors, would result in a **negligible** effect.

11.5.74 At night, due to the use of capped and direction lighting (set out in para. 11.2.3), 24 hour lighting at the Kirtling Street would be barely perceptible from these viewpoints. The magnitude of change to these receptors at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 2.7: View southeast and west from the Thames Path opposite the King William IV public house

11.5.75 Views from this location towards Kirtling Street and Heathwall Pumping Station would be affected by the presence of construction activity, construction plant, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. However, the construction activities would be set against other industrial uses, including the waste transfer station and Cemex concrete batching plant adjacent to the Kirtling Street site.

11.5.76 Views from this location would also be affected to a limited extent by construction activity at the Chelsea Embankment Foreshore site. The site cofferdam, tall construction plant and cranes at the site would be visible in the background of the view, largely obscured by Grosvenor Bridge and Chelsea Bridge. The foreground of the view west would be unaffected.

11.5.77 Therefore, the magnitude of change arising from construction at all three sites is considered to be medium.

11.5.78 The medium magnitude of change assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.79 At night, due to the use of capped and direction lighting (set out in para. 11.2.3), 24 hour lighting at the Kirtling Street would be barely perceptible from these viewpoints. The magnitude of change to these receptors at night is therefore considered to be negligible, resulting in a **negligible** effect.

Transport

Viewpoint 3.1: View west and northeast from the westbound carriageway of Nine Elms Lane

11.5.80 Construction activity at Kirtling Street would be visible from this viewpoint. The view would be affected by the wider presence of tall construction plant, the noise shed and cranes, and the foreground visibility of demolition, construction activity, welfare facilities and site hoardings in the southern part of the site. Views of other parts of the site would be partially obscured by buildings within the newly built Riverlight development, which would be assumed to be complete by Site Year 3 of construction (refer to para. 11.4.130).

11.5.81 Views from this location towards Heathwall Pumping Station would be also affected to a limited extent by the background presence of tall construction plant, cranes and construction traffic along Nine Elms Lane. Other construction activities at this site would be obscured by intervening buildings and structures, including those within the newly built Riverlight development which would be assumed to be complete by Site Year 3 of construction (refer to para. 11.4.130).

11.5.82 Due to the background visibility of some construction activity at Heathwall Pumping Station and the foreground visibility of construction activity in the southern extent of Kirtling Street, with wider views obscured by intervening buildings, the magnitude of change is considered to be medium.

11.5.83 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.84 At night, lighting at the southern end of the Kirtling Street site would be visible in the foreground of the view along the hoarding line and intermittently within the site. However, due to the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character of the foreground, 24 hour lighting at Kirtling Street would be barely perceptible from this viewpoint. The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 3.2: View north from Nine Elms Lane at the junction with Market Entrance

11.5.85 Views from this location across Nine Elms Lane would be affected by the removal of buildings and presence of welfare facilities, site hoardings and construction activity in the southern part of the site, and road traffic. Tall construction plant, the noise shed and cranes located at the northern end of the site, close to the river, would be intermittently visible. Therefore, the magnitude of change is considered to be medium.

11.5.86 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, would result in **moderate adverse** effects.

11.5.87 At night, lighting at the southern end of the Kirtling Street site would be visible in the foreground of the view along the hoarding line and intermittently within the site. However, due to the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character of the foreground, 24 hour lighting at Kirtling Street would be barely perceptible from this viewpoint. The magnitude of change to the receptor at night is therefore considered to be negligible, resulting in a **negligible** effect.

Viewpoint 3.3: View northeast from the eastbound carriageway of Battersea Park Road crossing the railway line

11.5.88 Views from this location towards the site would be affected to a limited extent during construction. Views up Battersea Park Road would be affected by construction activity in the southern part of the site, and road traffic, although much of the site would be obscured by intervening buildings in the Battersea Power Station site. Therefore, the magnitude of change is considered to be low.

11.5.89 The low magnitude of change, assessed alongside the medium sensitivity of the receptor, would result in **minor adverse** effects.

11.5.90 At night, 24 hour lighting at the Kirtling Street site would be barely perceptible from this viewpoint, due to intervening buildings obscuring the majority of the site, the use of capped and direction lighting (set out in para. 11.2.3) and the existing brightly lit character of the foreground. Therefore, the magnitude of change to the receptor at night is considered to be negligible, resulting in a **negligible** effect.

Visual effects – sensitivity test for programme delay

11.5.91 Para. 11.3.13 describes other developments assumed to be under construction at the same time as construction takes place at the Kirtling Street site. These are assessed cumulatively (Section 11.7). In the event that there is a programme delay of one year for the Thames Tideway Tunnel project, and assuming no change in the assumed rate of progress of the other developments, this would result in a re-categorisation of phases of these other developments from the cumulative assessment into base case, that is more phases would be assumed to be built and occupied with a delayed start to construction at the Kirtling Street site. While this would result in an increase in the number of visual receptors, the assessment already factors in these viewpoints and therefore the outcome of the assessment would remain unchanged.

11.6 Operational effects assessment

11.6.1 The following section describes the likely significant effects arising during the operational phase at Kirtling Street taking account of the Heathwall Pumping Station and Albert Embankment Foreshore sites (as detailed in Section 11.3).

11.6.2 Effect on tranquillity is one factor which informs the overall assessment of effects on townscape character. Since the operation of the proposed development would have little above-ground activity associated with it, (apart from infrequent maintenance visits) it is considered that the proposed development would have a negligible effect on tranquillity for all townscape character areas. This conclusion is not repeated for each character area discussed below.

11.6.3 Illustrative plans of the proposed development during operation are contained in a separate volume (Vol 14 Kirtling Street Figures – Section 1) and design principles describing environmental design measures are set out in Vol 1 Appendix B. Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint below.

Operational effects Year 1

Site character assessment

11.6.4 The proposed development would constitute a permanent improvement to the character of the site. The permanent works layout would result in a new area of hardstanding along the river frontage. Part of the site (including the river frontage) would be returned to Cemex. The remainder of the site working area would be left hoarded off for future development by others. The 4-6m high combined ventilation and electrical and control structure would introduce a small built element towards the river frontage of the site, close to the shaft. The structure would have a high quality concrete finish incorporating grooves and etching (the design intent for which is illustrated on the Proposed ventilation outlet and electrical and control kiosk design intent figure [see separate volume of figures – Section 1]). These elements would replace a number of existing buildings and structures, which currently have a detrimental effect on the character of the site.

11.6.5 The relocated Cemex operation (which also forms part of the proposed development) would comprise a number of cement silos up to 30m high and aggregate bins alongside other low level plant in the western section of the site adjacent to the waste transfer station.

11.6.6 The impacts on specific components of the site are described in Vol 14 Table 11.6.1.

Vol 14 Table 11.6.1 Townscape – impacts on baseline components in Year 1 of operation

ID	Component	Impacts
01	River wall	No impacts.
02	Trees and shrubs	Vegetation within the site boundary would not be replaced. Tree planting would be undertaken along the Thames Path which would run alongside the western edge of the site, along Kirtling Street.
03	Warehouses	Left cleared for future development.
04	Depot	Left cleared for future development.
05	Former petrol station	Left cleared for future development.
06	Commercial premises	Left cleared for future development.
07	Concrete batching works	Returned to use as a safeguarded wharf. The new facilities (further inland from the existing works) would remain following construction.

11.6.7 The majority of the site would be left as open hardstanding, replacing a mix of industrial buildings of poor condition. The combined ventilation and electrical and control structure and boundary wall would represent indistinct components within the site. Therefore, the magnitude of change is considered to be medium.

11.6.8 The medium magnitude of change, assessed alongside the low sensitivity of the site, would result in **minor beneficial** effects.

Townscape character areas assessment

11.6.9 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. Nine Elms Lane Residential

b. St George's Wharf Residential.

River Thames – Nine Elms Reach TCA

11.6.10 The proposed development at the Kirtling Street site would locally improve the setting of this character area through the demolition of existing dilapidated buildings and structures. The proposed development at Heathwall Pumping Station would also locally improve the setting of this character area by creating a public pedestrian frontage along the river and by partially screening the existing pumping station through new planting and well designed structures

11.6.11 The proposed development at Albert Embankment Foreshore would not substantially alter the setting of this character area. However, the CSO interception chamber on either side of Vauxhall Bridge would affect the setting of the reach to a limited extent by slightly altering the appearance of Vauxhall Bridge, an important part of this area's character. The change would be minimised through terracing to blend the interception chamber on the west side of the bridge into the surrounding foreshore, representing an improvement to the existing CSO outfalls which are highly visible adjacent to the bridge. The majority of the areas setting would be largely unaffected.

11.6.12 Due to the improvements in setting introduced by components of the proposed development at all three sites, the magnitude of change is considered to be low.

11.6.13 The low magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **minor beneficial** effects.

Nine Elms Lane Commercial TCA; and Battersea Industrial TCA

11.6.14 The setting of the areas would be affected by the demolition of dilapidated buildings at the Kirtling Street site.

11.6.15 The proposed development at Heathwall Pumping Station would also locally alter the setting of these character areas through improving the boundary to Middle Wharf, partially screening the pumping station and creating public access along the wharf and in front of the pumping station. However, the majority of the setting of both character areas would be largely unaffected. Therefore, the magnitude of change is considered to be low.

11.6.16 The low magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **minor beneficial** effects.

11.6.17 The assessment of specific effects on the setting of the Grade II listed Battersea Power Station as a heritage asset is set out in Section 7 of this volume. The historic environment assessment identifies a minor adverse effect on the setting of this asset due to slight changes in views of the power station.

Pimlico Residential TCA

11.6.18 The riverside setting of the area would also be affected by the demolition of dilapidated buildings at the Kirtling Street site.

11.6.19 The proposed development at Heathwall Pumping Station would also result in changes to the riverside setting of this character area, due to the creation of a new area of public realm in front of Heathwall pumping station, partially screening the existing pumping station through new planting and structures and providing a new well designed river wall. However, the majority of the setting would be largely unaffected. Therefore, the magnitude of change is considered to be low.

11.6.20 The low magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **minor beneficial** effects.

Townscape – sensitivity test for programme delay

11.6.21 For the assessment of townscape effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely materially to change the assessment findings reported above (paras. 11.6.4 to 11.6.20). 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 11.4.58).

Visual assessment

11.6.22 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.

11.6.23 No assessment of visual effects has been made for the following viewpoints, as the components of the operational scheme would not be visible or would be barely perceptible in the background of the view:

a. Viewpoint 1.1: View southwest and northeast from residences on Grosvenor Road opposite St George's Square

b. Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place

c. Viewpoint 1.3: View southwest and northeast from residences along Nine Elms Lane

d. Viewpoint 1.4: View southwest from residences along Nine Elms Lane close to Heathwall pumping station

e. Viewpoint 1.5: View northeast from residences along Battersea Park Road

f. Viewpoint 1.6: View southeast from residences along Grosvenor Road close to Telford Terrace

g. Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge

h. Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge

i. Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

j. Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development

k. Viewpoint 2.5: View east from the southern end of Chelsea Bridge

l. Viewpoint 2.6: View southeast from the northern end of Chelsea Bridge

m. Viewpoint 2.7: View southeast and west from the Thames Path opposite the King William IV public house

n. Viewpoint 3.3: View northeast from the eastbound carriageway of Battersea Park Road crossing the railway line

Residential

Viewpoint 1.7: View south and southeast from residences along Grosvenor Road, close to Churchill Gardens Estate

11.6.24 The view south towards the Kirtling Street site would be affected by the demolition of existing dilapidated buildings. However, the views of the site would remain typical of the surrounding industrial uses, including the neighbouring waste transfer station and Cemex concrete batching plant.

11.6.25 Views from residences towards the Heathwall Pumping Station site would be affected to a limited extent by the design of the new river wall around the foreshore structure. The site would form an indistinct component in the panoramic view, set against the context of the surrounding redevelopment which would be similar in character, comprising a public river frontage. The view of the existing pumping station would also be partially screened. The view of the proposed development from this viewpoint is illustrated in Vol 14 Plate 11.6.1 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 15 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 14 Plate 11.6.1 Viewpoint 1.7 – illustrative operational phase photomontage

Date taken: 6 May 2011. 50mm lens.

11.6.26 The magnitude of change arising from the operation of the proposed development at both sites is considered to be low.

11.6.27 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects.

11.6.28 There would be no change to the assessment during summer.

Viewpoint 1.8: View west from newly built residences in the Riverlight development (base case scheme)

11.6.29 Views from newly built residences towards the site would be affected by the clearance of dilapidated buildings, leaving an area of hardstanding. The character of the view would remain broadly typical of the existing industrial outlook, therefore the magnitude of change is considered to be low.

11.6.30 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects.

11.6.31 There would be no change to the assessment during summer.

Viewpoint 3.1: View west and northeast from the eastbound carriageway of Nine Elms Lane; and Viewpoint 3.2: View north from Nine Elms Lane at the junction with Market Entrance

11.6.32 Views from these locations towards the Kirtling Street site would encompass buildings cleared as part of the works, leaving a line of high quality hoardings along the pavement, broadly typical of existing views. The views towards the Heathwall Pumping Station site would be affected to a limited extent by the background visibility of new tree planting along Nine Elms Lane. However the overall character of the views would be largely unchanged, therefore the magnitude of change is considered to be negligible.

11.6.33 The negligible magnitude of change, assessed alongside the medium sensitivity of these receptors, would result in **negligible** effects.

11.6.34 There would be no change to the assessment during summer.

Visual effects – sensitivity test for programme delay

11.6.35 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. 11.6.23 to 11.6.34). 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. 11.4.60 to 11.4.129.

Operational effects Year 15

11.6.36 Operational effects for all townscape and visual receptors identified would remain unchanged in Year 15 compared to Year 1, due to the limited effect any maturing vegetation would have on the visibility of the site and the limited changes anticipated in the surrounding area in the Year 15 base case. This would also apply in the event of a programme delay to the Thames Tideway Tunnel project of approximately one year.

11.7 Cumulative effects assessment

Construction effects

11.7.1 As described in para. 11.3.13, a number of other schemes within the assessment area would be under construction during Site Year 3 of construction at the Kirtling Street site.

11.7.2 Cumulatively, construction activity at the Thames Tideway Tunnel project sites (Kirtling Street, Heathwall Pumping Station and Albert Embankment Foreshore) and all the developments described above, and construction traffic arising from all these sites, would elevate effects on the setting of all townscape character areas surrounding the site and visual assessment viewpoints within the assessment area.

11.7.3 Significant effects on receptors arising from the proposed Thames Tideway Tunnel project would remain significant when considered with non-Thames Tideway Tunnel developments. Effects during daytime on the following visual receptors (which are not significant from the Thames Tideway Tunnel project alone) would be significant when taking into account construction at the developments described in para.11.3.13:

a. Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace

b. Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge

c. Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge

d. Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

e. Viewpoint 2.6: View southeast from the northern end of Chelsea Bridge

f. Viewpoint 3.3: View northeast from the eastbound carriageway of Battersea Park Road crossing the railway line.

11.7.4 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, a greater proportion of the schemes listed above would be built and occupied with a corresponding reduced level of cumulative activity. In terms of townscape, there would remain a high level of cumulative construction and effects on townscape character areas would remain unchanged from those assessed. Similarly, while a programme delay would increase the number of visual receptors, the associated viewpoints are already factored into the assessment and again, findings for the visual assessment would be unlikely to change.

Operational effects

11.7.5 There would be no cumulative effects during Year 1 or Year 15 of operation (the assessment years) because no schemes relevant to the assessment of effects on townscape and visual receptors have been identified. Therefore, operational effects remain as described in Section 11.6. This would also apply in the event of a programme delay to the Thames Tideway Tunnel project of approximately one year.

11.8 Mitigation

11.8.1 All measures embedded in the proposed scheme and *CoCP* of relevance to the townscape and visual assessment are summarised in Section 11.2. No further 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 Section11.5. All residual effects are presented in Section11.10.

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 14 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 demolition of structures and the intensity of construction activity.	Minor adverse	None	Minor adverse
River Thames – Nine Elms Reach TCA	Change to setting due to construction activity at Kirtling Street and Heathwall Pumping Station, and the wider presence of construction activity at Albert Embankment Foreshore and Chelsea Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Nine Elms Lane Residential TCA	Change to riverside setting due to construction activity, traffic and construction plant at Heathwall Pumping Station, the river jetty at Kirtling Street and the cofferdam and construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
St George's Wharf Residential TCA	Wider change to setting due to construction activity at Kirtling Street and Heathwall Pumping Station. Change to immediate setting due to construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Nine Elms Lane Commercial TCA	Change to setting due to construction activity, construction plant and road transport and demolition of existing structures at Kirtling Street and Heathwall Pumping Station.	Moderate adverse	No mitigation possible	Moderate adverse
Battersea Industrial TCA	Change to setting due to construction activity, construction plant and road transport and demolition of existing structures at Kirtling Street and Heathwall Pumping Station.	Moderate adverse	No mitigation possible	Moderate adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Pimlico Residential TCA	Change to riverside setting due to construction activity and construction plant at both sites, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station.	Moderate adverse	No mitigation possible	Moderate adverse

Vol 14 Table 11.10.2 Visual – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential				
Viewpoint 1.1: View southwest and northeast from residences on Grosvenor Road opposite St George's Square	Visibility of construction activity, construction plant, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station. Background visibility of construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place	Visibility of construction activity, construction plant, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station. Background visibility of construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 1.3: View southwest and northeast from residences along	Visibility of construction activity, construction plant, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station. Background visibility of	Moderate adverse	No mitigation possible	Moderate adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Nine Elms Lane	construction activity at Albert Embankment Foreshore.			
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 1.4: View southwest from residences along Nine Elms Lane, close to the site	Oblique visibility of construction activity at Heathwall Pumping Station in the foreground and the river jetty at Kirtling Street in the background.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 1.5: View northeast from residences along Battersea Park Road	Foreground visibility of construction activity, construction plant, demolition and road traffic at Kirtling Street. Background visibility of construction activity at Heathwall Pumping Station.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace	Wider visibility of construction activity at Kirtling Street and Heathwall Pumping Station.	Minor adverse	None	Minor adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 1.7: View southeast and south from residences along Grosvenor Road, close to Churchill Gardens Estate	Visibility of construction activity at Kirtling Street and Heathwall Pumping Station across the river.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 1.8: View west from newly built	Foreground visibility of construction activity, cranes	Major	No mitigation	Major adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
residences in the Riverlight development (base case scheme)	and the cofferdam at Heathwall Pumping Station.	adverse	possible	
	At night, 24 hour lighting and continuous loading of barges at Kirtling Street would be visible.	Moderate adverse	No mitigation possible	Moderate adverse
Recreational				
Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge	Background visibility of construction activity at Kirtling Street and Heathwall Pumping Station.	Minor adverse	None	Minor adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge	Background visibility of construction activity at Kirtling Street and Heathwall Pumping Station.	Minor adverse	None	Minor adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge	Background visibility of construction activity at Kirtling Street and Heathwall Pumping Station.	Minor adverse	None	Minor adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development	Visibility of construction activity at Kirtling Street and Heathwall Pumping Station. Wider visibility of construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 2.5: View east from the southern end of	Background visibility of tall construction plant and cranes.	Negligible	None	Negligible

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Chelsea Bridge	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 2.6: View southeast from the northern end of Chelsea Bridge	Background visibility of tall construction plant and cranes.	Negligible	None	Negligible
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 2.7: View southeast and west from the Thames Path opposite the King William IV public house	Visibility of construction activity at Kirtling Street and Heathwall Pumping Station. Wider visibility of the cofferdam, tall construction plant and cranes at Chelsea Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Transport				
Viewpoint 3.1: View west and northeast from the eastbound carriageway of Nine Elms Lane	Foreground visibility of construction activity at Kirtling Street. Background visibility of construction at Heathwall Pumping Station.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 3.2: View north from Nine Elms Lane at the junction with Market Entrance	Foreground visibility of demolition and construction activity at Kirtling Street.	Moderate adverse	No mitigation possible	Moderate adverse
	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible
Viewpoint 3.3: View northeast from the	Background visibility of construction activity in the southern part of Kirtling Street.	Minor adverse	None	Minor adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
eastbound carriageway of Battersea Park Road crossing the railway line	At night, lighting at Kirtling Street would be barely perceptible.	Negligible	None	Negligible

Vol 14 Table 11.10.3 Townscape – summary of Year 1 and Year 15 operational assessment[ii]

Receptor[iii]	Effect	Significance of effect	Mitigation	Significance of residual effect
The site	Change in character through clearance of existing dilapidated buildings.	Minor beneficial	None	Minor beneficial
River Thames – Nine Elms Reach TCA	Slight change to setting due to clearance of existing dilapidated buildings at Kirtling Street and creation of a public river frontage at Heathwall Pumping Station.	Minor beneficial	None	Minor beneficial
Nine Elms Lane Commercial TCA	Slight improvement to setting due to clearance of existing dilapidated buildings.	Minor beneficial	None	Minor beneficial
Battersea Industrial TCA	Slight improvement to setting due to clearance of existing dilapidated buildings.	Minor beneficial	None	Minor beneficial
Pimlico Residential TCA	Slight change to setting due to clearance of existing dilapidated buildings at Kirtling Street and creation of a public river frontage at Heathwall Pumping Station.	Minor beneficial	None	Minor beneficial

[ii] Operational effects have been assessed to be the same in both Year 1 and Year 15 of operation

[iii] Townscape character areas not assessed during operation (refer to para. 11.6.6) are not included in the summary table

Vol 14 Table 11.10.4 Visual – summary of Year 1 and Year 15 operational assessment[iv]

Receptor[v]	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential				
Viewpoint 1.7: View south and southeast from residences along Grosvenor Road, close to Churchill Gardens Estate	Visibility of the clearance of dilapidated buildings at Kirtling Street and the new public river frontage at Heathwall Pumping Station.	Winter – Minor beneficial	Winter – None	Winter – Minor beneficial
		Summer – Minor beneficial	Summer – None	Summer – Minor beneficial
Viewpoint 1.8: View west from newly built residences in the Riverlight development	Foreground visibility of cleared dilapidated buildings and new area of hardstanding.	Winter – Minor beneficial	Winter – None	Winter – Minor beneficial
		Summer – Minor beneficial	Summer – None	Summer – Minor beneficial
Viewpoint 3.1: View west and northeast from the eastbound carriageway of Nine Elms Lane	No significant change to the character of the view.	Winter – Negligible	Winter – None	Winter – Negligible
		Summer – Negligible	Winter – None	Summer – Negligible
Viewpoint 3.2: View north from Nine Elms Lane at the junction with Market Entrance	No significant change to the character of the view.	Winter – Negligible	Winter – None	Winter – Negligible
		Summer – Negligible	Winter – None	Summer – Negligible

[iv] Operational effects have been assessed to be the same in both Year 1 and Year 15 of operation

[v] Viewpoints not assessed during operation (refer to para. 11.6.19) are not included in the summary table

References

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

[2] LB of Wandsworth. *LDF Core Strategy* (October 2010).

[3] LB of Lambeth. *LDF Core Strategy* (January 2011).

[4] City of Westminster. *LDF Core Strategy* (January 2011).

[5] City of Westminster. *Conservation Area Information Leaflets* (May 2004).

[6] Department of Environment, Food and Rural Affairs (2012). 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: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 12: Transport

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

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Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling 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 Kirtling 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. London Underground and National Rail services

e. river services, usage and river navigation

f. car parking

g. highway layout, operation and capacity.

12.1.3 The assessment considers the effects on each of these elements during construction, as well as effects on specific receptors including residents of adjacent houseboats and developments and users/occupiers of nearby businesses.

12.1.4 The operation of the Kirtling Street site has the potential to affect highway layout and operation and therefore effects on these are considered within the operational assessment.

12.1.5 The assessment of transport presented in this section has considered the requirements of the National Policy Statement for Waste Water (Defra, 2012)[1] section 4.13. Further details of these requirements can be found in Vol 2 Section 12.3.

12.1.6 Additionally, a separate *Transport Assessment* has also been produced which provides an assessment of the effects on the transport network as a result of the construction and operational phases at the Kirtling 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 14 Kirtling Street figures).

12.1.8 The separate but related assessments of effects of transport on air quality and noise and vibration are contained in Vol 14 Sections 4 and 9 respectively.

12.2 Proposed development relevant to transport

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

Construction

12.2.2 The construction site would be located on existing industrial areas south of the River Thames. Vehicle access to and from the site would be from Nine Elms Lane (A3205) or Battersea Park Road via Cringle Street and Kirtling Street. Kirtling Street would need to be closed to general traffic, except Cemex vehicles, at its northern and northwestern sections for the duration of the construction period.

12.2.3 During construction it is anticipated that the elements listed under para. 12.1.2 may be affected as a result of the additional construction traffic and workers associated with this and other Thames Tideway Tunnel project sites in the area and the diversion of the Thames Path.

12.2.4 Details of the peak year of construction, anticipated lorry and barge movements and the activities that would generate these movements are provided in Vol 14 Table 12.2.1.

Vol 14 Table 12.2.1 Transport – construction details

Description	Assumption
Assumed peak period of construction lorry movements	Site Year 3 of construction
Assumed average peak daily construction lorry vehicle movements (in peak month of Site Year 3 of construction)	192 movements per day (96 vehicle trips)
Assumed peak period of construction barge movements	Site Year 3 of construction
Assumed average peak daily construction barge movements (in peak month of Site Year 3 of construction)	8 movements per day (4 barge trips)
Types of lorry requiring access (comprising rigid-bodied, flatbed and articulated vehicles)	Office delivery lorries Temporary construction material lorries including pipe/track/oils/greases lorries Plant and equipment lorries Readymix mixer lorries

Description	Assumption
	Steel reinforcement lorries Excavated material lorries Cement tanker lorries Aggregate lorries Tunnel precast concrete linings lorries

Note: a movement represents a one way trip. 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 excavated material from the main tunnel (export) and secondary lining aggregates (import) would be transported by barge from the site. For the transport assessment it has been assumed that 90% of these materials are taken by river. This allows for periods that the river is unavailable and material is unsuitable for river transport. All other materials would be transported by road.

12.2.6 A temporary jetty would be provided to transfer excavated material via conveyors from the site to barges.

12.2.7 While construction activity would occur 24 hours a day for some periods, vehicle movements would only 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). Vehicle movements would also be limited to these hours during periods when longer working hours would be required. It is only in exceptional circumstances that HGV and abnormal load movements could occur up to 22:00 on weekdays for large concrete pours and later at night by agreement with the LB of Wandsworth.

Construction traffic routing

12.2.8 The access plan and highway layout during construction (phases 1-3) plan (see separate volume of figures – Section 1) shows the highway layout during construction.

12.2.9 The Kirtling Street site is located adjacent to Kirtling Street and Cringle Street, which are accessed from Nine Elms Lane (A3205). Nine Elms Lane (A3205) forms part of the Transport for London Road Network (TLRN).

12.2.10 The majority of construction vehicles would travel to/from the east using the TLRN via Nine Elms Lane (A3205) and Vauxhall Gyratory.

12.2.11 A proportion of site traffic would however route to/from the west along Nine Elms Lane (A3205) and Battersea Park Road (A3205).

12.2.12 Vol 14 Figure 12.2.1 (see separate volume of figures) shows the construction traffic routes for access to/from the Kirtling Street site. Construction routes have been discussed with both Transport for London (TfL) and the Local Highway Authority (LHA), the LB of Wandsworth, for the purposes of the assessment.

12.2.13 Access to the Kirtling Street site from the TLRN (Nine Elms Lane and Battersea Park Road (A3205) would be via Kirtling Street for construction traffic.

12.2.14 Kirtling Street north of Cringle Street would be closed to public traffic during the construction period.

12.2.15 The Kirtling Street site would operate with four access points during the construction period. Construction vehicles would approach northbound along Kirtling Street from the junction with Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road into the main access on Cringle Street. This access would be for entry only. The main site exit would be in the northeast corner of Kirtling Street from where vehicles would route back to the TLRN (Nine Elms Lane (A3205)) via Cringle Street.

12.2.16 Access to the southern area of the site would be to/from Cringle Street on its southern side between its two junctions with Kirtling Street. This would operate on a right-turn in, right-turn out basis only.

12.2.17 During Phases 1 and 3 of construction at the Kirtling Street site, a further exit would be located in the northern side of Cringle Street and would operate as left-turn out only.

12.2.18 It is noted that access to the Cemex site adjacent to the Thames Tideway Tunnel project Kirtling Street site would be on Kirtling Street. Exit from the Cemex site would be onto Cringle Street west of the main Thames Tideway Tunnel project site access.

Construction workers

12.2.19 The construction site is expected to require a maximum workforce of 426 workers on site. However, as a result of shift patterns, there would be a maximum of 235 workers on site at any one time. The number and type of workers is shown in Vol 14 Table 12.2.2.

Vol 14 Table 12.2.2 Transport – construction worker numbers

Contractor					Client	
Staff*		Labour**			Staff***	
08:00-18:00	18:00-08:00	08:00-15:00	15:00-23:00	11:00-08:00	08:00-18:00	18:00-08:00
80	20	90	90	75	65	6

** Staff Contractor – engineering and support staff to direct and project manage the engineering work and site.*
contract staff brought in to 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.*
Note: The table shows maximum number of workers required (426). However, as a result of shift patterns the maximum work force on site would be 235 occurring during the day shift (08:00 – 18:00). Travel for the workers would occur both during and outside of these hours.

12.2.20 At the Kirtling Street site there would be no parking provided within the site boundary for workers. As parking on surrounding streets would also be restricted as part of the traffic management works necessary to provide access to the site, and measures to reduce car use would be incorporated into the site-specific Travel Plan (prepared by the contractor in accordance with the overall aims and objectives of the *Draft Project Framework Travel Plan*), it is highly unlikely that workers would travel by car. It is therefore assumed that construction workers would access the site by other modes of transport, further details of which are provided in Vol 14 Table 12.5.1.

Code of Construction Practice

12.2.21 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

c. site specific *River Transport Management Plans* (RTMP) are to be produced for each relevant worksite. As with the TMP's this would set out how river access to site would be managed so as to minimise impact on the river and communicate this with the PLA, local borough and other stakeholders.

12.2.22 In addition to the general transport measures within the *CoCP Part A*, the following measures have been incorporated into the *CoCP Part B* (Section 5) relating to the Kirtling Street site:

a. access to/from the site would be from Kirtling Street and Cringle Street

b. there would be no direct access to and from the Kirtling Street site from Nine Elms Lane (A3205) between Kirtling Street and Cringle Street junctions

c. construction traffic would utilise a route one-way system on Kirtling Street and Cringle Street. Except where being shown as stopped up on the access plan, Kirtling Street and Cringle Street would be kept open for two-way movements for general (non-construction) traffic

d. exit from the site onto Kirtling Street is by the Riverlight development including the car park entrance/exit and nursery. The contractor would put in measures to manage potential conflicts with vehicles entering and exiting the site at these access points and other traffic on Cringle Street and pedestrians and cyclists on the Thames Path

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

e. the site access onto the southern side of Cringle Street would operate as right turn in and right turn out only for construction vehicles. The site exit on the northern side of Cringle Street would operate as left turn out only.

f. the site encompasses part of the existing Cemex site. Access to the Cemex site would be maintained throughout the construction period via Kirtling Street with egress via Cringle Street

g. bus stand in Cringle Street to be relocated

h. the diversion of the Thames Path would be adequately signed.

12.2.23 The effective implementation of the *CoCP* Part A and Part B measures is assumed within the assessment.

12.2.24 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 Kirtling Street site

b. a mode split established for the Kirtling Street site construction workers to establish and monitor travel patterns

c. site-specific targets and interim targets would be established based on the mode share which would link to objectives based on local, regional and national policy

d. a nominated person with responsibility for managing the Travel Plan monitoring and action plans specifically for this site.

Other measures during construction

12.2.25 Embedded design measures which are not outlined in the CoCP but are of relevance to the transport assessment at the Kirtling Street site include the closure of the northern and northwestern section of Kirtling Street and the introduction of a one way system to accommodate this.

Operation

12.2.26 During operation the site would be accessed by maintenance vehicles via an existing access on Kirtling Street north of Cringle Street (as set out in the Kirtling Street design principles report Section 4.11, see Vol 1 Appendix B) that would also be used to access the Cemex site.

12.2.27 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 which would require access to enable two mobile cranes and support vehicles to be brought to 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 the assessment for transport are presented in Vol 14 Table 12.3.1.

12.3.2 It is noted that it was reported in the *Scoping Report* that operational traffic effects for the project as a whole were scoped out of the environmental impact assessment (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 14 Table 12.3.1 Transport – stakeholder engagement

Organisation	Comment	Response
Transport for London, Transport Assessment workshop, November 2012	No information on quantum of traffic demand for committed developments	This information is provided in the Kirtling Street *Transport Assessment*
Transport for London, Transport Assessment workshop, November 2012	Details on parking proposals and extents of restrictions regarding the removal of on-street parking on Kirtling Street and Cringle Street must be provided as part of a wider traffic management plan	Detail is provided in the *CoCP Part B* for this site. Further information would be provided by the contractor and discussed with the LB of Wandsworth and TfL.
Transport for London, Transport Assessment workshop, November 2012	Traffic management proposals are not described in sufficient detail. Detailed traffic management plans are requested for full impact assessment.	Detail is provided in the *Transport Assessment* and *CoCP Part B* for this site. Further information would be provided by the contractor and discussed with the LB of Wandsworth and TfL.
Transport for London, Transport Assessment workshop, November 2012	Local highway improvement schemes affecting vehicle and pedestrian routes around the site area are proposed. Drawings for the highway schemes proposed as part of	Highway improvement schemes proposed by other committed developments are presented on the construction base case drawings in the *Transport*

Organisation	Comment	Response
	other nearby developments must be submitted.	*Assessment* figures.
Transport for London, Transport Assessment workshop, November 2012	Provide weekend traffic flows to justify lack of weekend modelling	Saturday traffic flows on Nine Elms Lane are provided in the Kirtling Street *Transport Assessment*
Transport for London, Transport Assessment workshop, November 2012	Nearby junctions not considered in impact analysis. Provide justification for junctions not being modelled	The scope of local highway modelling for Kirtling Street was discussed with TfL. The performance of the wider network is considered in the project-wide assessment (Vol 3).
Transport for London, Transport Assessment workshop, November 2012	Lack of detailed signal timing data collected (such as cycle time, green time, etc)	Signal timing data for the Kirtling Street / Battersea Park Road / Nine Elms Lane / New Covent Garden Market access road junction was obtained from TfL
Transport for London, Transport Assessment workshop, November 2012	Bus relocation from Cringle Street to Kirtling Street: Undertake traffic impact assessment (ie, road widths, swept paths) to ensure viability. Further discussion with TfL Buses to obtain agreement.	Drawings and vehicle swept path analyses are included in the Kirtling Street *Transport Assessment*. The relocation of this bus stand has been discussed with TfL Buses.
Transport for London, Transport Assessment workshop, November 2012	Lack of parking controls for shift workers. Include measures for control of shift worker parking in Travel Plan	Information is provided in the *Draft Project Framework Travel Plan*. Further details will be provided in the Kirtling Street site-specific Travel Plan prepared by the site contractor.
Transport for London, Transport Assessment workshop, November 2012	Amount of parking provision for operational site is currently unclear. Provide further detail on how much parking for maintenance vehicles will be made available.	An area would be made available to accommodate two large cranes and associated support vehicles during the ten yearly inspections.
Port of London Authority (PLA), Section 48 consultation, November 2012	The PLA is not certain how the conclusion was reached in the environmental information report that the effects of the construction phase will give rise	The impact of the Thames Tideway Tunnel project on the river passenger services have been assessed in the ES and have been explained

Organisation	Comment	Response
	to minor adverse effects on the commercial use of the river by neighbouring businesses [Cemex and Cringle Dock Waste Transfer Station]. In any event, this level of effect is considered to be unacceptable and must be appropriately mitigated.	in Section 12.5.
LB of Wandsworth, interim consultation, August 2012	Background traffic growth assumptions should be discussed with TfL in relation to their assessment of the Northern Line Extension.	Traffic growth assumptions used in the assessment have been discussed with TfL.
LB of Wandsworth, interim consultation, August 2012	Regarding Thames Tunnel assumptions on background traffic growth provided in a summary table, the following comments should be considered: a. Thames Tideway Tunnel shows a 7 year construction period, but shows a steady movement throughout that period. Is it unlikely that the construction traffic profile will be that smooth. b. NLE construction is programmed between 2015 and 2019. c. Battersea Power Station – likely construction will commence in 2013 and could extend over this period. However from 2015 there will also be operational traffic coming from this site as Phase 1 is occupied. d. US Embassy - A figure should be included for construction traffic (say 4/6) , which is due to commence 2014 and be complete in	a. The Thames Tunnel trips in the summary table are presented as being at the average peak throughout the construction period. In reality, trips would be less than this peak during most of the construction period. b. This assumption has been used in the assessment. However, it is noted that this programme is subject to change. c. This assumption has been used in the assessment. However, it is noted that this programme is subject to change. d. This assumption has been used in the assessment. e. This assumption has been used in the assessment. f. A construction end date

Organisation	Comment	Response
	2017. e. Embassy Gardens – Construction start in 2012 and you should estimate a suitable flow (6/7?). There is likely to be some operational traffic from 2015 onwards. f. New Covent Garden market - suggest 2025 as more realistic end date. Again there will be construction traffic from later phases and operational traffic from the earlier phases. g. Market Towers – 2013 is a more realistic start date with a 4 year build out. h. Battersea Concrete Plant – would expect an increase in traffic as it will hopefully supply many of the construction sites in the area.	of 2021 has been assumed in line with the New Covent Garden Market Transport Assessment. This represents a worst case assessment as more trips will be generated post-construction than during. g. This assumption has been used in the assessment. h. Noted.
LB of Wandsworth, consultation workshop, June 2012	Assessment of the impact of lorry movements in the transport assessment must include the cumulative impact of lorry movements from other development within the Opportunity Area.	The assessment considers committed developments in the area around the Kirtling Street site. Details of the developments considered are given in paras. 12.3.6-12.3.7.
LB of Wandsworth, consultation workshop, June 2012	It is unclear what the difference is between secondary and primary routes and at what times or circumstances you are likely to use the secondary routes.	Primary routes are the preferred routes to and from the site and the assessment is based on these primary routes.
LB of Wandsworth, consultation workshop, June 2012	St Johns Hill, Lavender Hill and Wandsworth Road are local roads with primarily residential and retail frontage and therefore should not be used by construction vehicles. Queenstown Road and	Construction vehicle routing has been revised to avoid these roads following discussions with stakeholders.

Organisation	Comment	Response
	Silverthorne Road to the south of the Tarmac and London Concrete Battersea site, which should takes its access from Battersea Park Road (A3205), should also not be used by construction vehicles.	
LB of Wandsworth, consultation workshop, June 2012	Battersea Bridge Road, Prince of Wales Drive, Albert Bridge Road, Latchmere Road and Elspeth Road are residential and contain two low bridges and should be removed if a logical alternative TLRN route is available.	The construction route is to avoid the two low bridges and would use York Road/ Swandon Way/ Wandsworth Bridge Road/ Trinity Road roundabout and the junction just to the south (Woodwell Street junction). The construction routes described in Section 12.2 have been used for the assessment.
LB of Wandsworth, phase two consultation, January 2012	A riverside walk of 6m in width should be provided post construction which would follow the Thames frontage. A new access path is also sought which would run from Kirtling Street towards the Thames Path along the western boundary of the site.	As the shaft is located on a safeguarded wharf, the final river frontage would not be provided by the Thames Tideway Tunnel project but by the subsequent developer of the site (ie, the design does not preclude future provision of a riverside walk).
LB of Wandsworth, phase two consultation, January 2012	The use of the river should be maximised at the Kirtling Street site and Thames Water should investigate further the potential to transfer 100% of the excavated material by river.	The Transport Strategy sets out that the river will be used for the transfer of materials at the Kirtling Street site. For the purposes of the assessment it is assumed that 90% of main tunnel excavated material and 90% of main tunnel secondary tunnel lining aggregates are transported by barge. This 90% assumption is believed to be a realistic maximum to account for the periods that the river is unavailable or material is unsuitable for river transport
LB of Wandsworth, phase two	Thames Water must ensure that any movement of materials both	The project has considered the need to minimise

Organisation	Comment	Response
consultation, January 2012	in and out of the site are minimised.	unnecessary material movement and the assessment is based on the proposed *Transport Strategy* which takes account of these considerations.
Transport for London, phase two consultation, February 2012	The impact on the Nine Elms Lane (A3205) junctions with Cringle Street and Kirtling Street, including any proposed modifications, during construction will need to be assessed and discussed further with TfL.	The operation of junctions of Nine Elms Lane (A3205) / Cringle Street and Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction have been assessed (see Section 12.5).
Transport for London, phase two consultation, February 2012	Further work on the completed scheme needs to be undertaken to ensure that the re-instatement provides an improved Thames Path and public realm appropriate for this changing location.	As the shaft is located on a safeguarded wharf, the final river frontage would not be provided by the Thames Tideway Tunnel project but by the subsequent developer of the site (ie, the design does not preclude future provision of a publically-accessible river frontage).
Transport for London, phase two consultation, February 2012	The construction management plans for works at Battersea Power Station and Riverlight should be reviewed and similar principles adopted if possible.	An outline construction management plan for Battersea Power Station was included in the application material but lacks the detail required to inform the Thames Tideway Tunnel project. If this plan develops before construction begins at the Thames Tideway Tunnel Kirtling Street site it would be referred to as appropriate. The Riverlight construction management information available has been reviewed. Road closures and vehicle routings have been noted, although the different locations of the access points at the Thames Tideway Tunnel Kirtling Street site require different principles to

Organisation	Comment	Response
		be employed.
Transport for London, phase two consultation, February 2012	The number of vehicle movements between sites must be determined and assessed if Kirtling Street is used as a hub site for Heathwall.	Offices and welfare facilities would be located at the Kirtling Street site. However, this would not generate vehicle movements between the sites.
Transport for London, phase two consultation, February 2012	The impact of the proposed diversion of the Thames Path along Nine Elms Lane (A3205) will need assessing and appropriate mitigation put forward, including pedestrian crossings, diversionary signage etc which will need to be discussed further with TfL.	The impact of the Thames Path diversion is fully assessed. Appropriate signage would be erected to notify pedestrians of the diversion as set out in the *CoCP Part B*.
LB of Wandsworth, consultation workshop, July 2011	Investigate whether permitting all movements by construction vehicles at the Nine Elms Lane (A3205) / Cringle Street junction would create significant impact on traffic. Investigate whether this junction should be signalised.	This has been considered in the assessment which concludes that there would be no need to signalise this junction.
LB of Wandsworth, consultation workshop, July 2011	During construction it would be most suitable to divert the Thames Path along Nine Elms Lane (A3205) between Heathwall Pumping Station and Kirtling Street.	It is proposed to divert the Thames Path onto Nine Elms Lane (A3205) between Cringle Street and Kirtling Street only. This diversion route is proposed because it represents the minimum level of change from the existing route.
LB of Wandsworth, consultation workshop, July 2011	Check bus stops / stand location on Nine Elms Lane (A3205) and Cringle Street then review vehicle swept paths and liaise with TfL Buses to determine whether stops require relocation.	Bus stops on Nine Elms Lane (A3205) would not require relocation. The bus stand on Cringle Street would however need to be relocated to the southern section of Kirtling Street. This has been discussed with TfL.
LB of Wandsworth, consultation workshop, July	The current level of usage of parking in Kirtling Street and Cringle Street should be investigated and the impact of	This has been addressed within this assessment (see Section 12.5).

Organisation	Comment	Response
2011	removing this parking determined.	
LB of Wandsworth, consultation workshop, July 2011	The likely road layout changes as a consequence of US Embassy proposals in the area should be investigated.	The US Embassy development includes proposals for Ponton Road to be realigned and to be signalised at its junction with Nine Elms Lane (A3205) approximately 150m west of its current location. This has been taken into account in the assessment.
LB of Wandsworth, scoping response, January 2011	This site is expected to have a workforce of 175 during the daytime. Thames Water will need to prepare a plan at all sites to deal with staff travel, but this site is particularly important given the larger numbers.	The maximum number of workers on site would be 235 at any one time. A *Draft Project Framework Travel Plan* has been produced which includes requirements and guidelines for site specific travel planning measures.
LB of Wandsworth, scoping response, January 2011	Highway layout is to be assumed to remain the same as existing during construction despite Battersea Power Station proposals	To assess a reasonable worst case scenario the EIA assumes that the Battersea Power Station development is under construction during the peak period of construction at Kirtling Street. However, the *Transport Assessment* also assesses a scenario where the Battersea Power Station proposals are not implemented.
LB of Wandsworth, scoping response, January 2011	The residents of house boats moored at the Nine Elms Pier community and Tideway Village should be consulted to determine their requirements regarding parking spaces.	Parking for the Nine Elms Pier community will be provided by the Riverlight development on their site (currently the Tideway Wharf Industrial Estate). It is not necessary to provide parking for the residents of Tideway Village.

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 with the exception of the method of local capacity modelling. Due to the number of committed developments in the Nine Elms area the base case traffic flows in the TfL HAMs are lower than the expected flows. Background traffic flows have therefore been calculated using information available for each committed development site and manually adding these into the models as described further in para. 12.3.10.

12.3.5 The effect of all other Thames Tideway Tunnel project sites on the area surrounding the Kirtling Street site (for example, the Heathwall Pumping Station site) has been taken into account within the assessment of the peak year of construction at this site.

12.3.6 There are a number of developments identified within 1km of the Kirtling Street site that would be complete and operational by Site Year 3 of construction meaning that they would form part of the base case (unless the information has not been available). These are identified in the site development schedule (see Vol 14 Appendix N) along with additional sites identified in liaison with TfL and LB Wandsworth. These developments are:

a. Northern Line Extension

b. US Embassy

c. Market Towers

d. Island Site Vauxhall Gyratory

e. Nine Elms Sainsbury's

f. Spring Mews, Vauxhall[ii]

g. Vauxhall Sky Gardens

h. Riverlight development

i. St George's Wharf (Vauxhall Tower)

j. Marco Polo House (Phase 1a and 1b)

k. Battersea Power Station (Phase 1- 3)

l. Embassy Gardens (Buildings A02, A05,and A09- A11)

m. New Covent Garden Market (Buildings B4- B6)

n. 10 Pascal Street

o. Riverwalk House, Millbank

p. 1-9 Bondway and 4-6 South Lambeth Place

12.3.7 There are also some developments that would be under construction at the same time as construction works at the Kirtling Street site. These are:

a. 81 Black Prince Road (Parliament Road)[ii]

b. 10 Albert Embankment (Hampton House)[ii]

c. 20 Albert Embankment (Wah Kwong House)[ii]

d. Chelsea Barracks

e. Marco Polo House (Phase 2)

f. Battersea Power Station (Phase 4-6)

g. Nine Elms Parkside (Plots B- D)

h. Embassy Gardens (Buildings A01, A03, A04 and A07)

i. New Covent Garden Market (Buildings B1- B3 and site entrance)

j. Vauxhall Square Cap Gemini

12.3.8 This means that the transport assessment should consider cumulative effects in relation to those developments under construction at the same time as construction works in Site Year 3 at the Kirtling Street site.

12.3.9 The TfL Highway Assignment Models (HAMs) have been developed using GLA employment and population forecasts, which are based on the employment and housing projections set out in the London Plan (GLA, 2011)[4]. As a result the assessment inherently takes into account a level of future growth and development across London.

12.3.10 However, it is expected that because of the scale and rate of change in the wider Nine Elms area, trips associated with the committed developments in the vicinity of the Kirtling Street site could significantly alter the operation of the highway network in the future. From inspection of the TfL HAM for this area, it is not clear whether the changes associated with committed developments are fully represented at the detailed local level and therefore in assessing the transport effects of this site, it has been discussed with TfL and LB Wandsworth that specific allowance should be made in the local highway models for trips associated with the above listed developments in addition to the growth factors derived from the HAMs.

12.3.11 The assessment of transport effects is based on the Battersea Power Station development being partially completed and partially under construction in Site Year 3 of construction at the Kirtling Street site. This includes a new highway layout at the Kirtling Street/Battersea Park Road/Nine Elms Lane (A3205)/New Covent Garden access road junction. However, as there are some uncertainties around the timescale for implementation of the Battersea Power Station development a sensitivity test has been undertaken in which the construction base and development cases assume that the Battersea Power Station development is not

[ii] These sites have been identified in liaison with TfL and LB of Wandsworth, which are in addition to those indicated in the site development schedule (see Vol 14 Appendix N)

progressed within a timescale that coincides with the Thames Tideway Tunnel project, and hence the highway layout would be as existing. This sensitivity test is presented in the *Transport Assessment.*

Construction assessment area

12.3.12 The assessment area for the Kirtling Street site includes the site accesses from Kirtling Street and Cringle Street, which are local roads off Nine Elms Lane (A3205), which is part of the TLRN. The junctions of Kirtling St / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road and Cringle Street / Nine Elms Lane (A3205) have been assessed for highway, cycle and pedestrian impacts.

12.3.13 The Thames Path has been included within the assessment due to its proximity to the development site. Effects on local bus services within 640m of the site and rail services within 960m of the site have also been assessed[iii].

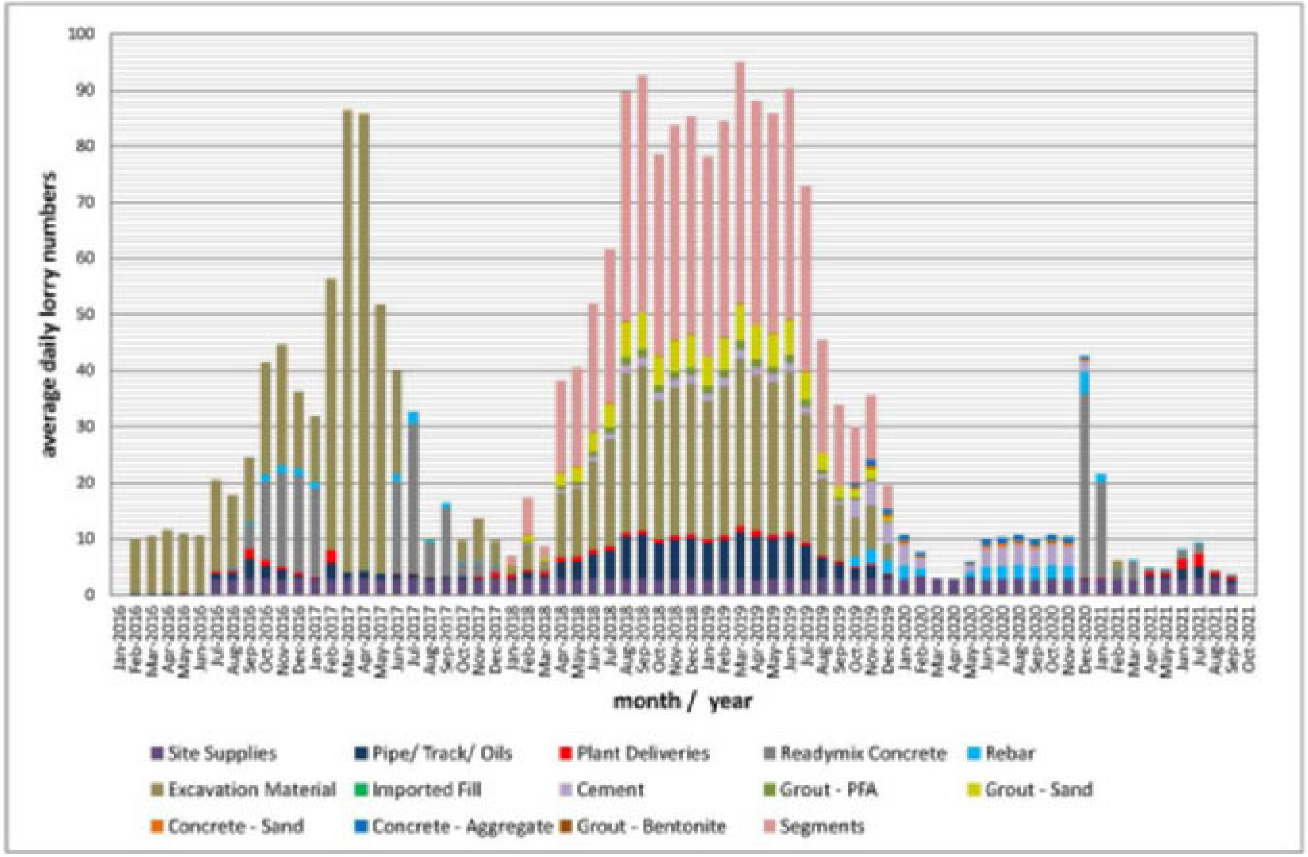
Construction assessment years

12.3.14 The site-specific peak construction assessment year has been identified. The histograms in Vol 14 Plate 12.3.1 and Vol 14 Plate 12.3.2 show that the peak site-specific activity at the Kirtling Street site would occur in Site Year 3 of construction for both construction lorries and construction barges.

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

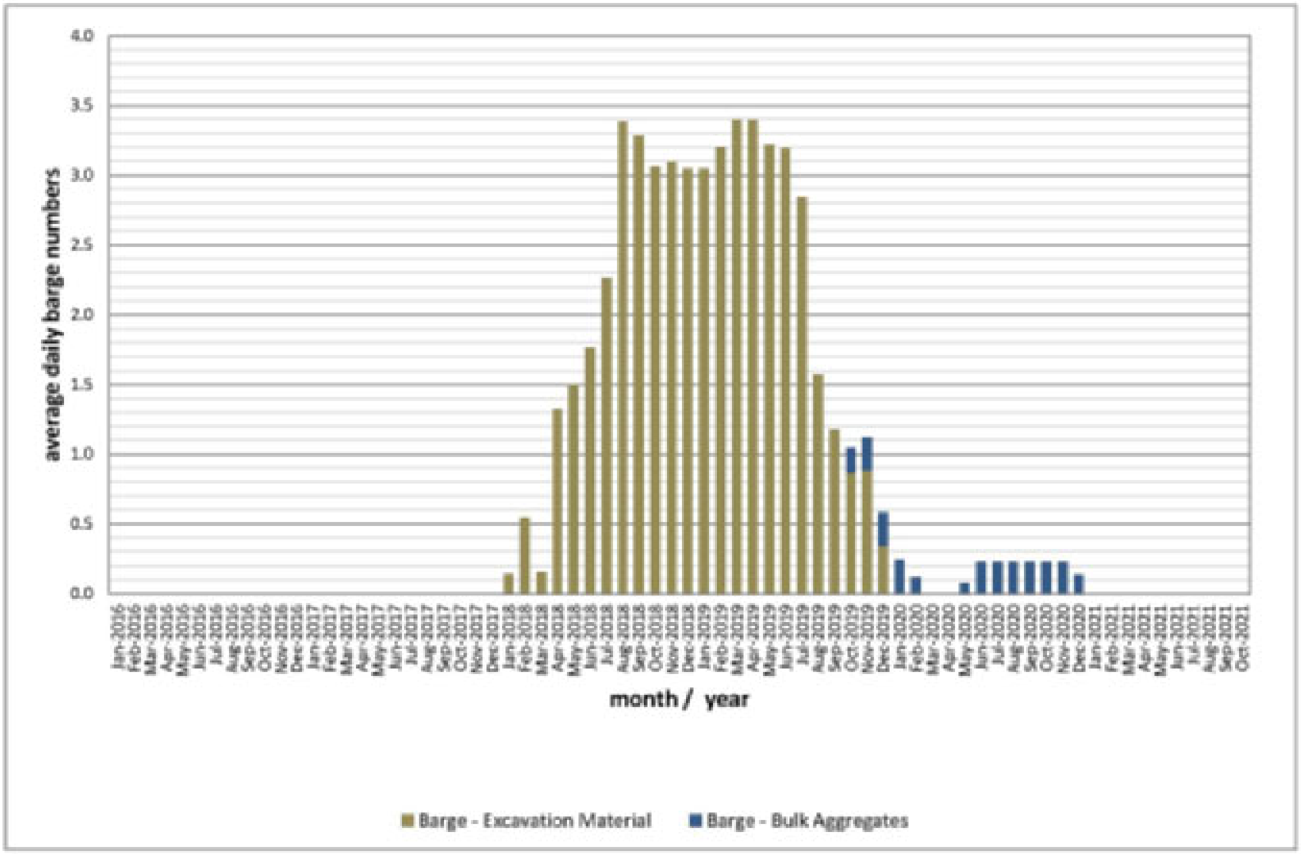
[iii] Distances derived from the Public Transport Accessibility Level (PTAL) methodology described in Volume 2.

Vol 14 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.

Vol 14 Plate 12.3.2 Transport – estimated construction barge profile



Note: Plate shows approximate volumes and number of barge trips based upon assumed timings for the works. It is not a programme and remains subject to change.

Operation

12.3.16 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.

12.3.17 Once the Thames Tideway Tunnel project is operational it is anticipated that there would be no significant effects on the transport infrastructure and operation within the local area because maintenance trips to the site would be infrequent and short-term. However, the physical aspects of access to the site for maintenance have been considered in relation to highway layout and operation.

12.3.18 These aspects 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 Wandsworth and TfL.

12.3.19 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 Kirtling Street site are assessed. Other Thames Tideway Tunnel project sites, including that at Heathwall Pumping Station, would not affect the area around the Kirtling Street site in the operational phase and therefore it is not necessary to consider them in the assessment.

12.3.20 With regard to other developments in the vicinity of the Kirtling Street site (as detailed in the site development schedule, see Vol 14 Appendix N) and as identified in liaison with TfL and LB Wandsworth, the following developments would be complete and operational by Year 1 of operation:

a. Northern Line Extension
b. US Embassy
c. New Covent Garden Market (Buildings B1- B6 and site entrance)
d. Market Towers
e. Island Site Vauxhall Gyratory
f. Vauxhall Square Cap Gemini
g. Nine Elms Sainsburys
h. 81 Black Prince Road (Parliament House)[iv]
i. Spring Mews[iv]
j. Riverlight development
k. Chelsea Barracks
l. Embassy Gardens
m. Vauxhall Sky Gardens

[iv] These sites have been identified in liaison with TfL and LB of Wandsworth, which are in addition to those indicated in the site development schedule (see Vol 14 Appendix N)

n. Marco Polo House

o. Battersea Power Station (Phases 1-4, part of phase 5, phase 6)

p. St George's Wharf (Vauxhall Tower)

q. Nine Elms Parkside (Plots A-D)

r. 10 Pascal Street

s. Riverwalk House, Millbank

t. 1-9 Bondway and 4-6 South Lambeth Place

u. 10 Albert Embankment (Wah Kwong House)[iv]

v. 20 Albert Embankment (Hampton House) [iv]

12.3.21 There are also some developments that would still be under construction in Year 1 of operation of the Kirtling Street site. These are:

a. Battersea Power Station (Phase 7 and part of phase 5)

b. Nine Elms Parkside (Plots E-G)

c. New Covent Garden Market (Buildings T1-T3)

12.3.22 As a result these developments have been included within the operational base case which takes into consideration the effects on highway layout and operation.

Operational assessment area

12.3.23 The assessment area for the operational assessment remains the same as for the construction assessment as set out in paras. 12.3.12-12.3.13.

Operational assessment year

12.3.24 As outlined in Vol 2 Section 12 the operational assessment year has been taken as Year 1 of operation which is the year in which it is assumed that the Thames Tideway Tunnel project would be operational. As the number of vehicle movements associated with the operational phase is low there is no requirement to assess any other year beyond that date.

12.3.25 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

12.3.26 The general assumptions and limitations associated with this assessment are presented in Vol 2 Section 12.

Assumptions

12.3.27 As described in para. 12.3.11, this assessment assumes that the Battersea Power Station development is under construction concurrently with the Kirtling Street site. Sensitivity testing has been undertaken to determine what the effects would be should the Battersea Power Station site be developed after the Kirtling Street site is operational. The results of the sensitivity test are contained within the *Transport Assessment*.

12.3.28 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.

12.3.29 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 Kirtling Street site, it is assumed that there would be two hazardous loads per week generated by the site.

12.3.30 With regard to construction workers travelling to the site, it is assumed that no construction workers would drive to the site, as set out in para. 12.5.3.

Limitations

12.3.31 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 Vol 14 Figure 12.4.1 (see separate volume of figures) provides a site location plan for the Kirtling Street site. Construction vehicles would use the TLRN via Nine Elms Lane (A3205) and then Kirtling Street and Cringle Street to access the site.

Pedestrian routes

12.4.3 The existing pedestrian network and facilities in the vicinity of the site are shown in Vol 14 Figure 12.4.2 (see separate volume of figures).

12.4.4 The Thames Path from the south follows the riverside to Battersea Power Station where it routes along Cringle Street and Kirtling Street before returning to the riverside at the Riverlight development site. The route then follows the river edge returning briefly to Nine Elms Lane (A3205) before rejoining the riverside. The Thames Path passes William Henry Walk opposite the Westminster Boating Base before rejoining Nine Elms Lane (A3205) and passing along Wandsworth Road (A3036) to Vauxhall Bridge (A202).

12.4.5 Nine Elms Lane (A3205) provides a continuous east-west link for pedestrians along the south side of the Kirtling Street site. The footways on either side of Nine Elms Lane (A3205) vary in width from 3m to 6m.

12.4.6 Pedestrian crossing facilities with dropped kerbs and tactile paving are provided on all arms of the signalised junction of Kirtling Street with Nine Elms Lane (A3205), Battersea Park Road (A3205) and the New Covent Garden access road.

12.4.7 Approximately 100m east of this junction, there is a signalised pedestrian crossing facility which aids north-south pedestrian movements. Additional pedestrian crossings are located to the east of the site at the signalised junctions of Nine Elms Lane (A3205) with Ponton Road, St George's Wharf and Wandsworth Road (A3036).

12.4.8 Pedestrian crossings are also provided on Nine Elms Lane (A3205) to the west of the junction of Kirtling Street at the junctions of Battersea Park Road (A3205) with Prince of Wales Drive and Queenstown Road (A3216).

12.4.9 Kirtling Street has footways 2m wide on both sides of the two-way vehicular carriageway providing a continuous north-south link between Nine Elms Lane (A3205) and Battersea Park Road (A3205) and the southern bank of the River Thames.

12.4.10 Cringle Street provides local access from Nine Elms Lane (A3205) and Kirtling Street as well as Gate 1 at Battersea Power Station at its western end. The street has footways each of approximately 1.8m width provided on both sides of the carriageway along with street lighting.

12.4.11 Dropped kerb crossings are provided at its junctions with both Nine Elms Lane (A3205) and Kirtling Street.

Cycle facilities and routes

12.4.12 The existing cycle network and facilities in the vicinity of the site are shown in Vol 14 Figure 12.4.2 (see separate volume of figures).

12.4.13 The main cycle route within the area is National Cycle Network Route 4 (off road) which routes eastwards and westwards along Nine Elms Lane (A3205). The cycle path is shared with pedestrians and is segregated from traffic travelling along Nine Elms Lane (A3205) / Battersea Park Road (A3205). Road markings and signage are in place to alert pedestrians to the presence of the cycle path.

12.4.14 Advanced stop lines for cyclists are in place on all arms of the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road signalised junction, except on the New Covent Garden access road.

12.4.15 The closest Cycle Superhighway (CS) to the site is CS8 which routes between Wandsworth and Westminster. CS8 passes along Battersea Park Road (A3205) and Queenstown Road (A3216) to Chelsea Bridge (A3126) continuing from there to Westminster. The cycle journey time between Wandsworth and Westminster is approximately 30 minutes. The closest point on CS8 to the Kirtling Street site is at Queenstown Road (A3216) approximately 885m to the southwest.

12.4.16 The closest cycle hire docking station is at Vauxhall Gyratory approximately 1.1km walking distance to the east of the site. The docking station is located on the western footway of Parry Street (A3036) and accommodates 17 bicycles.

12.4.17 Cyclists also use the Thames Path which is described in para. 12.4.4.

12.4.18 There are no on-street cycle parking areas within the vicinity of the site. The closest cycle parking facilities are provided at the Battersea Park National Rail station on Battersea Park Road (A3205) within the western footway approximately 810m walking distance southwest of the site; where there are two parking stands provided.

Public Transport Accessibility Level

12.4.19 The Public Transport Accessibility Level (PTAL) of the Kirtling Street 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).

12.4.20 Using this methodology the site has a PTAL rating of between 3 and 4, rated as 'moderate' (with 1a being the lowest accessibility and 6b being the highest accessibility).

12.4.21 Vol 14 Figure 12.4.3 (see separate volume of figures) shows the public transport network around the Kirtling Street site.

Bus routes

12.4.22 As shown in Vol 14 Figure 12.4.3 (see separate volume of figures) three daytime bus routes operate within 640m of the site serving local destinations. These bus routes operate from the following bus stops:

a. Sleaford Street bus stop on Nine Elms Lane (A3205) (eastbound and westbound – 270m walking distance west of the site)

b. Elm Quay Court bus stop on Nine Elms Lane (A3205) (eastbound and westbound – 400m walking distance east of the site)

c. Ascalon Street bus stop on Nine Elms Lane (A3205) (eastbound and westbound) - 420m walking distance southwest of the site)

d. Battersea Dogs and Cats Home bus stop on Nine Elms Lane (A3205) (eastbound and westbound – 580m walking distance west of the site).

12.4.23 These routes would also serve other stops further from the site as shown on Vol 14 Figure 12.4.3 (see separate volume of figures).

12.4.24 On average there are a total of 21 bus services per hour in the AM peak hour and 21 bus services per hour in the PM peak hour within a 640m walking distance of the Kirtling Street site.

12.4.25 A bus stand is located on Cringle Street that allows TfL buses to park when not in operation. As far as can be established this stand is not regularly used by TfL buses.

12.4.26 There is one night-time bus route within a 640m walking distance of the site, route 344, which stops at Cringle Street, and is a 24 hour service with two to four buses per hour during the night.

12.4.27 Vauxhall bus station is approximately 1.1km walking distance or 14 minutes walk northeast of the Kirtling Street site. This bus station serves a large number of bus services. It provides on average 146 daytime bus services in total per hour in the AM and PM peak hours and approximately six night-time bus services per hour.

London Underground

12.4.28 There are no London Underground services within a 960m walking distance from the site. However, Vauxhall Underground station is located approximately 1.1km walking distance or 14 minutes walking time northeast of the site and is served by the Victoria Line. Vol 14 Figure 12.4.3 (see separate volume of figures) shows the services from this station.

12.4.29 Victoria Line trains serving Vauxhall travel northbound to Green Park, King's Cross, Tottenham Hale and Walthamstow Central and southbound to Brixton.

12.4.30 In the AM and PM peak hours the service frequency on the Victoria Line is approximately every two to five minutes providing up to 21 services per hour in each direction.

National Rail

12.4.31 As shown in Vol 14 Figure 12.4.3 (see separate volume of figures), the closest National Rail station to the site is Battersea Park station approximately 810m walking distance to the west of the site.

12.4.32 Battersea Park station provides access to Southern Railway train services which provides northbound services to London Victoria and southbound services to Sutton (Surrey), London Bridge and Caterham.

12.4.33 In the AM peak hour there are approximately 32 services. In the PM peak hour there are approximately 27 services.

12.4.34 Queenstown Road station is located approximately 1.1km walking distance or 14 minutes walking time to the southwest of the site (300m south of Battersea Park).

12.4.35 Queenstown Road provides access to South West Trains services and provides northbound services to London Waterloo and southbound services towards Clapham Junction and Weybridge.

12.4.36 In each of the AM and PM peak hours there are approximately 16 services (eight southbound and eight northbound services) which call at Queenstown Road.

12.4.37 Vauxhall Station is located approximately 1.1km walking distance or 14 minutes walking time to the northeast of the site. Vauxhall Station provides access to South West Trains services and provides southbound services to Guildford, Woking, Clapham Junction, Chessington South, Hampton Court and Shepperton and northbound services to London Waterloo.

12.4.38 In each of the AM and PM peak hours there are approximately 90 and 82 services respectively calling at Vauxhall station.

River passenger services

12.4.39 There are no passenger service piers in the immediate vicinity of the Kirtling Street site with the nearest pier located at St George Wharf Pier on the south bank of the river approximately 1.2km walking distance to the northeast of the site.

12.4.40 River passenger services at St George Wharf Pier provide a route to Blackfriars Millennium Pier in the AM and PM peak hours with two services in each direction with a frequency of approximately every 30 minutes. Outside of peak hours the service travels from St George Wharf to Bankside via Milbank and Embankment.

River navigation

12.4.41 The Kirtling Street site is located adjacent to Cringle Dock, which is a waste transfer station for the Western Riverside Waste Authority. Waste arriving at this facility is containerised and transported by barge to the new Belvedere energy from waste plant. This is a daily operation and comprises arriving and departing tugs each towing up to three barges.

12.4.42 An analysis has been made of the typical volume of river vessel traffic passing the Kirtling Street site, based on published river passenger service timetables and estimates of freight traffic based on discussions with operators. It is estimated that the peak hour is between 14:00 and 15:00, Monday to Friday. During this hour approximately 11 vessels are estimated to pass the site plus the additional two or three vessels servicing Cringle Dock described above. This figure is not constant as freight vessel transit patterns, which are included in the traffic, are influenced by the rising and falling tide. Therefore, such a peak will only occur every 10 to 12 days when the tide is at its highest[6].

Parking

12.4.43 Vol 14 Figure 12.4.4 (see separate volume of figures) shows the locations of the existing car parks and car club spaces within the vicinity of the site.

Existing on-street car parking

12.4.44 There is on-street parking in place along Kirtling Street and Cringle Street. The majority of the parking provision is restricted to one side of the carriageway, however some sections of Kirtling Street have parking on both sides of the carriageway.

12.4.45 Parking in this area is unrestricted and not subject to a controlled parking zone (CPZ).

12.4.46 No on-street parking is permitted along Nine Elms Lane (A3205) or Battersea Park Road (A3205), which are part of the TLRN.

Existing off-street/private car parking

12.4.47 A Sainsbury’s car park is located on Wandsworth Road approximately 1.3km walking distance east of the Kirtling Street site . This parking is intended for customers’ use only.

12.4.48 The riverboat communities on Nine Elms Pier have 14 parking spaces within the ‘Riverlight’ development that is adjacent to the Kirtling Street site.

Coach parking

12.4.49 The nearest coach parking is at New Covent Garden Market coach park which is immediately south of the site on the New Covent Garden access road. There are 25 bays available which are intended for customer use only.

Car clubs

12.4.50 The nearest car club space to the Kirtling Street site is operated by ZipCar and is on Thessaly Road approximately 400m walking distance to the south where space for one car is provided.

Servicing and deliveries

12.4.51 There are no on-street loading bays near the Kirtling Street site. Nine Elms Lane (A3205) / Battersea Park Road (A3205) is part of the TLRN and no stopping is permitted along this road at any time. There are however, a number of unrestricted parking areas along Cringle Street and Kirtling Street which could be used for on-street servicing and deliveries.

Taxis

12.4.52 There are no taxi rank facilities within 960m of the site.

Highway network and operation

12.4.53 Kirtling Street is a two lane single carriageway which routes north from its junction with Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road towards the River Thames, bisecting Cringle Street. Near the River Thames, Kirtling Street continues east then doubles back southward where it forms a priority junction with Cringle Street.

12.4.54 Cringle Street is an east-west two lane single carriageway that links to Kirtling Street. The Nine Elms Lane (A3205) / Cringle Street junction is a priority junction and a 30mph speed limit is in place on Cringle Street.

12.4.55 The junction of Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road is controlled by traffic signals.

12.4.56 There are further signalised junctions along Nine Elms Lane (A3205) to the west of Kirtling Street including those at Prince of Wales Drive and Queenstown Road (A3216). To the east of the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction there are also a number of signalised junctions including Ponton Road, St George’s Wharf and Wandsworth Road (A3036).

12.4.57 Nine Elms Lane (A3205) / Battersea Park Road (A3205) forms part of the TLRN and is a four lane carriageway of which one lane on each side of the road is a bus lane. A 30mph speed limit applies and the road is suitable for HGVs and long vehicles. The road links to Vauxhall Gyratory (A3036) in the east and Queenstown Road (A3216) in the west.

12.4.58 Vauxhall Gyratory (A3036) is part of the TLRN and is a six lane one way gyratory system including a bus lane that circulates around Vauxhall Rail, Underground and Bus stations at Vauxhall. This gyratory is immediately east of Vauxhall Bridge.

12.4.59 Queenstown Road (A3216) is a three lane single carriageway that runs in a north/south direction and has a northbound bus lane providing access to Battersea Park and Central London. Queenstown Road (A3216) forms part of London's Strategic Road Network (SRN).

Data from third party sources

Description of data

12.4.60 Data in relation to five-year accident records have been sourced from TfL.

Accident analysis

12.4.61 During the five year period a total of 36 accidents were recorded within the assessment area.

12.4.62 Of these accidents 31 were classified as slight and four were serious. The majority of these accidents were the result of vehicle drivers or riders failing to look properly before undertaking a poor turn or manoeuvre, or through pedestrians not using the dedicated crossing appropriately. One accident was fatal and occurred on Battersea Park Road (A3205) approximately 100m northeast of Prince of Wales Drive.

12.4.63 The highest number of accidents (27) occurred along Battersea Park Road (A3205) with 24 recorded as slight, two recorded as serious and one as fatal. Only one of these accidents involved an HGV and eight involved LGVs.

12.4.64 The data suggests none of the accidents were due to the highway geometry or limited visibility on the highway network within the vicinity of the site.

Survey data

Description of surveys

12.4.65 Baseline survey data were collected in May, July, August and September 2011 to establish the existing transport movements and usage of parking in the area. Vol 14 Figure 12.4.5 (see separate volume of figures) shows the survey locations in the vicinity of the site.

12.4.66 The surveys included manual and automated traffic surveys 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 on-street car parking and surveys were conducted to establish the summer usage of the Thames Path.

12.4.67 Traffic surveys were carried out on a weekday and a weekend to represent a weekly profile of traffic at particular locations. Where two weekly profiles are surveyed, the busiest survey was used.

Results of the surveys

12.4.68 The surveys inform the analysis of the baseline situation in the area surrounding the site.

Pedestrians and cyclists

12.4.69 Pedestrian surveys were undertaken at five locations around the site during the AM and PM peak hours. Pedestrian and cycle surveys show that there is a higher volume of pedestrian and cycle movements along Battersea Park Road (A3205) than along the Thames Path.

12.4.70 The pedestrian surveys show that there is a low flow of pedestrians during the AM peak hour along the Thames Path footway adjacent to the Battersea Barge restaurant of approximately 21 pedestrians in total. During the PM peak hour the flow is similar with approximately 11 pedestrians in total on the Thames Path.

12.4.71 A survey along Battersea Park Road (A3205) between Thessaly Road and Sleaford Street indicated a higher volume of pedestrian movements during the AM peak hour of approximately 205 pedestrians in total. During the PM peak hour the flow is slightly lower with approximately 170 pedestrians in total on this section of road.

12.4.72 The cycle surveys show that cycling levels close to the site are low. The Thames Path has lighter cycle usage with only two and one cyclists travelling in the southwestbound direction in the AM and PM peak hours respectively.

12.4.73 The junction counts suggest greater cycle usage along Battersea Park Road (A3205), to the west of the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction with a maximum of eight cyclists travelling westbound in the AM peak, and 14 cyclists in the eastbound in the PM peak.

12.4.74 The flows on Nine Elms Lane (A3205) at the junction with Cringle Street had no cyclists travelling in the northeastbound direction and one southwestbound in the AM peak hour, while in the PM peak hour there were four travelling northeastbound and nine southwestbound.

Traffic flows

12.4.75 ATC data collected as part of the surveys have been analysed to identify the existing traffic flows along Nine Elms Lane (A3205) at its junction with Ponton Road. The weekday vehicle and HGV flows for a 12-hour period (07:00-19:00) are used as this is when the greatest impacts from the project are likely to be experienced.

12.4.76 The data shows that the PM peak for Nine Elms Lane (A3205) is the busiest westbound hour with a maximum of approximately 270 vehicles every 15 minutes. Similar flows are experienced in the busiest eastbound hour which occurs in the AM peak.

12.4.77 The traffic flows for the busiest periods (weekday AM and PM peak hour) within the area are shown in Vol 14 Figure 12.4.6 and Vol 14 Figure 12.4.7 (see separate volume of figures).

Parking

12.4.78 The results of the parking surveys indicate that usage of the on-street parking along Kirtling Street and Cringle Street is moderate but that there is spare capacity available on both weekdays and weekends during the peak and off-peak periods.

12.4.79 The parking surveys suggested that about 60% of all available spaces were used throughout the day. The utilisation is lower in the Saturday peak than on weekdays.

Local highway modelling

12.4.80 To establish the existing capacity on the local highway network a scope has been discussed with TfL and the LB of Wandsworth to model the signalised Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction using LinSig, and the Nine Elms Lane (A3205) / Cringle Street priority junction using PICADY. 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.

12.4.81 The weekday AM and PM baseline model flows for the two junctions were compared against observed queue lengths (from the junction surveys) for the peak periods to validate the LinSig and PICADY models and ensure reasonable representation of existing conditions.

12.4.82 shows the LinSig modelling outputs for the Kirtling Street / Nine Elms Lane (A3205) junction Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden Market access road junction which demonstrates that the junction is currently operating with spare capacity in the weekday AM and PM peak hours. The validated model indicates that the AM and PM peak hours are relatively balanced with maximum queue lengths of approximately seven PCUs in both the AM and PM peak hours (on Nine Elms Lane (A3205) westbound). The delay to vehicles is most significant on the New Covent Garden Market right ahead movement, which currently experiences an average of 33 seconds of delay per PCU in both the AM and PM peak hours.

12.4.83 Vol 14 Table 12.4.1 shows the PICADY modelling outputs for the Cringle Street / Nine Elms Lane (A3205) junction which operates within capacity in both weekday peak hours. The validated model indicates that the AM and PM peak hours are relatively balanced and with no queues generated. The delay to vehicles is at a maximum during the AM peak hour on the Cringle Street approach at 16 seconds per vehicle.

Vol 14 Table 12.4.1 Transport – baseline LinSig model outputs

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)	Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)
Kirtling Street	Left / ahead / right	27	9%	1	32	33	10%	1	32
Nine Elms Lane (A3205)	Left / ahead	467	50%	7	19	448	48%	7	19
	Ahead / right	418	46%	7	20	412	46%	7	20
New Covent Garden Market	Left	67	10%	1	18	68	10%	1	18
	Right /ahead	27	8%	1	33	22	7%	0	33
Battersea Park Road (A3205)	Left / ahead	377	41%	6	16	380	41%	6	17
	Right	484	44%	6	19	419	40%	6	17
		PRC		**Total delay (PCU hours)**		**PRC**		**Total delay (PCU hours)**	
Overall junction performance		79.7%		10		85.9%		9	

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 14 Table 12.4.2 Transport – baseline PICADY model outputs

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (vehs)	RFC	Max. Queue (vehs)	Delay (seconds per veh)	Flow (veh)	RFC	Max. Queue (vehs)	Delay (seconds per veh)
Cringle Street	Left / ahead / right	18	8%	0	16	62	19%	0	14
Nine Elms Lane (E) (A3205)	Right	25	8%	0	13	25	7%	0	10

Notes: 1. RFC represents Ratio of Flow to Capacity. Queue represents number of vehicles in queue. Delay represents the mean delay per vehicle.
2. Nine Elms Lane (A3205) westbound is not included in table as PICADY model only considers movements where vehicles have to give way.

Transport receptors and sensitivity

12.4.84 The receptors and their sensitivities in the vicinity of the Kirtling Street site are summarised in Vol 14 Table 12.4.3. The transport receptor sensitivity is defined as high, medium or low using the criteria detailed in Vol 2 Section 12.

12.4.85 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.

12.4.86 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 14 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[v]) using the Thames Path and local highway network.	Construction	High sensitivity to footway closures and diversions, resulting in increases to journey times.
Private vehicle users (including taxis) in the area using the local highways or on-street parking.	Construction Operation	Medium sensitivity to road network changes leading to journey time change and to changes in parking availability and activity.
Emergency vehicles using Kirtling Street, Cringle Street and Nine	Construction Operation	High sensitivity to journey time delays due to time constraints on journey

[v] 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
Elms Lane (A3205) / Battersea Park Road (A3205)		purposes.
Marine emergency services	Construction	High sensitivity to changes in vessel movements / moorings due to time constraints on journey purposes.
Bus users (passengers) travelling along Nine Elms Lane (A3205) / Battersea Park Road (A3205) and through the Vauxhall Gyratory.	Construction	Medium sensitivity to road network changes leading to journey time change or to patronage changes
Public transport users using rail or river services within the area	Construction	Low sensitivity to patronage changes
River vessel operators including river passenger services.	Construction	Medium sensitivity to increases in construction barges.
Residents of the houseboats at Tideway Village, 45m west of the site Residents of the Nine Elms Pier houseboats (22 vessels), adjacent to site Users of Battersea Barge restaurant	Construction Operation	Medium sensitivity to changes to access regime for pedestrians, vehicles and river navigation
Users and operators of Cemex concrete batching works (remaining on site)	Construction	Medium sensitivity to changes to access regime for vehicles

Receptors (relating to all identified transport effects)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
Users and operators of Cringle Dock Waste Transfer Station, adjacent to site	Construction	Low sensitivity to changes to access regime including river navigation

Construction base case

12.4.87 As described in Section 12.3 the construction assessment year for transport is Site Year 3 of construction.

12.4.88 There are a number of committed developments within the LB Wandsworth in the vicinity of the Kirtling Street site which are expected to be complete and operational by Site Year 3 of the Kirtling Street site construction, these are listed in para. 12.3.6 and have been considered in the assessment.

12.4.89 Changes to the pedestrian and cycle network by Site Year 3 of construction would occur as a result of the developments at Battersea Power Station, the US Embassy and Embassy Gardens, Nine Elms Parkside and Vauxhall Sky Gardens.

12.4.90 The changes would include providing signalised pedestrian crossing facilities on all arms of the Nine Elms Lane (A3205) / Battersea Park Road (A3205) / Kirtling Street / New Covent Garden Market access junction, re-routing of the Thames Path to Cringle Street via the new Battersea Power Station development, improved public realm surrounding Nine Elms Parkside and Vauxhall Sky Gardens and realignment of Ponton Road including pedestrian refuge islands at the junction.

12.4.91 It is anticipated that patronage on public transport services may also change between the baseline situation and Site Year 3 of construction. Future patronage changes on bus, rail and river networks will be driven by a range of complex factors and there are inherent uncertainties in setting a patronage level for a future year.

12.4.92 Therefore, in order to ensure that a busiest base case scenario is used in the assessment, the capacity for public transport services in the construction 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.

12.4.93 There are no known current proposals to alter river passenger services or river navigation patterns from the current baseline conditions and therefore the construction base case in Site Year 3 of construction remains similar to the baseline position.

12.4.94 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 Kirtling Street site in Site Year 3 of construction without the Thames Tideway Tunnel project. The construction base case traffic flows (derived from the survey data) which provide input to the LinSig and PICADY models are shown on Vol 14 Figure 12.4.6 and Figure 12.4.7 (see separate volume of figures).

12.4.95 As explained in para. 12.3.10, for the local highway modelling at this site consideration has been given to the traffic flows that may be generated by the surrounding committed developments, which are outlined in para. 12.3.6.

12.4.96 In line with the approach used for local modelling at all sites, growth factors from the TfL HAMs for the LB of Wandsworth have been applied to the baseline traffic flows. In addition, because of the scale of development change in the area, information on traffic associated with each of the committed developments has been sourced and compiled, and this traffic has also been added to the baseline traffic flows to produce construction base case flows for the local modelling.

12.4.97 Transport network changes associated with the committed developments, where known, have also been included in the construction base case local models. These changes, by Site Year 3 of construction at the Kirtling Street site, include:

a. suspension of parking on Kirtling Street and Cringle Street (as a result of the Battersea Power Station development proposals)

b. provision of a dedicated right-turn lane from Nine Elms Lane (A3205) into Kirtling Street

c. provision of two lanes on the Kirtling Street arm of the Nine Elms Lane (A3205) / Battersea Park Road (A3205) / Kirtling Street / New Covent Garden Market access junction

d. realignment of Ponton Road (as a result of the US Embassy development proposals)

e. upgrade of the Ponton Road / Nine Elms Lane (A3205) junction and potentially two new junctions along Nine Elms Lane (A3205) (as a result of the US Embassy development proposals)

f. conversion of Cringle Street / Nine Elms Lane (A3205) junction from T-junction to a crossroad (as a result of the Nine Elms Parkside redevelopment proposals)

12.4.98 The assessment is based on the programmed implementation of the Battersea Power Station development. However as there are uncertainties surrounding the actual timescales for implementation, a sensitivity test has been undertaken within the highway modelling and public transport assessments to determine whether if the Battersea Power Station development were excluded from the base case, the assessment would produce any different outcomes. This sensitivity test is reported in the *Transport Assessment*.

12.4.99 The construction base case LinSig and PICADY models for the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction and the Nine Elms Lane (A3205) /

Cringle Street priority junction respectively indicate that the local network will continue to within capacity.

12.4.100 The resulting construction base case LinSig model output for the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction indicates that the level of saturation on some approaches will increase to near capacity and queuing and delays will increase slightly.

12.4.101 The construction base case PICADY model for Nine Elms Lane (A3205) / Cringle Street junction indicates that the maximum ratio of flow to capacity will be in the PM peak hour on the Cringle Street approach with 58%. The longest delay will also occur in the PM peak hour at 60 seconds on the right turn lane of Nine Elms Parkside.

12.4.102 The construction base case includes the optimisation of signal timings for the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) junction in order to minimise journey time increases within the local area.

12.4.103 Developments within 250m of the site are considered to present potential receptors to transport effects, as described in Vol 2 Section 12. For the Kirtling Street site, the committed developments within 250m of the site have been identified from the site development schedule (Vol 14 Appendix N) and these have been included as receptors in the assessment of construction effects.

12.4.104 This results in the addition of four new receptors, as detailed in Vol 14 Table 12.4.4.

Vol 14 Table 12.4.4 Transport – construction base case additional receptors

Receptors (relating to all identified transport effects)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
Occupiers of Battersea Power Station, Riverlight, New Covent Garden Market, and Embassy Gardens developments	Construction Operation	High sensitivity as pedestrians and cyclists Low sensitivity as highway users Medium sensitivity as parking users following occupation of these developments which is expected prior to completion of construction at Kirtling Street site

Operational base case

12.4.105 The operational assessment year for transport is Year 1 of operation.

12.4.106 The elements of the transport network considered in the operational assessment are highway layout and operation. For the purposes of the operational base case it is anticipated that the highway layout will be as indicated in the construction base case.

12.4.107 The operational base case, Year 1 of operation, takes into account the developments described in the site development schedule (see Vol 14 Appendix N) as described in paras. 12.3.20 and 12.3.21. Given that the effects in the operational phase would be limited to effects on highway operation in the immediate vicinity of the Kirtling Street site it is not necessary to consider additional receptors beyond those identified for the construction base case in Vol 14 Table 12.4.4.

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 Kirtling Street site (Site Year 3 of construction for both construction lorry and construction barge movements).

12.5.2 The anticipated mode split or worker trips (covering all types of construction worker described in Vol 14 Table 12.2.2) for Kirtling Street is detailed in Vol 14 Table 12.5.1 and has been generated based on 2001 Census data for journeys to workplaces within the vicinity of the Kirtling Street site[vi].

12.5.3 At this site there would be no parking provided within the site boundary for workers. The availability of parking on surrounding streets would be restricted as part of the traffic management works necessary to provide access to the site, and measures to reduce car use would be incorporated into site-specific Travel Plan requirements, and therefore it is highly unlikely that workers would travel by car. The Census mode shares have therefore been adjusted in Vol 14 Table 12.5.1 to reflect increased levels of non-car use by workers at this site. This forms the basis of the assessment.

Vol 14 Table 12.5.1 Transport – mode split

Mode	Percentage of trips to site	Equivalent number of worker trips	
		AM peak (07:00-08:00)	PM peak (18:00-19:00)
Bus	20.0%	47	29
National Rail	33.5%	79	49

[vi] Based on 2001 Census as this type of data had not been released from the 2011 Census at the time of assessment.

Mode	Percentage of trips to site	Equivalent number of worker trips	
		AM peak (07:00-08:00)	PM peak (18:00-19:00)
Underground	28.8%	68	42
Car driver	<1%*	0	0
Car passenger	<1%*	0	0
Cycle	3.7%	9	5
Walk	8.8%	21	13
River	0.6%	1	<1
Other (taxi/motorcycle)	4.6%	10	7
Total	**100%**	**235**	**145**

Note: The peak travel time for construction workers is anticipated to occur between 07:00-08:00 and between 18:00-19:00 and the PM peak hour trips would be lower than the AM peak hour trips as shift changes occur at 15:00.
** Assumed to be zero for the purposes of the assessment.*

Pedestrian routes

12.5.4 There would be no changes required to pedestrian routes at the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction or the Cringle Street / Nine Elms Lane (A3205) junction as part of the construction proposals at the Kirtling Street site.

12.5.5 Pedestrians would not be able to access the northern and northwestern section of Kirtling Street as this would form part of the construction site. This would result in a diversion for pedestrians using the Thames Path. Pedestrians using the Thames Path would route from the riverside to Kirtling Street along the existing path adjacent to the Riverlight development and then route south along Kirtling Street (instead of west) to Cringle Street then west through the Battersea Power Station development.

12.5.6 The construction phasing (phases 1-4) plans (see separate volume of figures – Section 1) show the layout of the pedestrian footways during construction.

12.5.7 There would be additional vehicle crossovers on Kirtling Street and Cringle Street where new site access points would be constructed. These would be provided with tactile paving and dropped kerbs. These new accesses would create additional vehicle/pedestrian conflict points. However, the number of pedestrians expected to be walking along these sections of Kirtling Street and Cringle Street would be very low because of the proposed diversion of the Thames Path during the construction work.

12.5.8 To assess a busiest case scenario it has been anticipated that all worker trips would finish their journeys by foot. As a result it has been assumed that 235 worker trips in the AM peak hour and 145 in the PM peak hour would travel on the pedestrian network near to the Kirtling Street site. This would create up to a total flow of 440 pedestrians in the vicinity of the Kirtling Street site in the AM peak and 315 in the PM peak hour when taking into account the existing flows from the pedestrian surveys.

12.5.9 Taking into consideration the pedestrian diversions and increase in worker trips the greatest effect would be on the northern footway along Nine Elms Lane (A3205) to which pedestrians would be diverted from the riverside footway of the Thames Path.

12.5.10 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).

12.5.11 It is anticipated that the pedestrian diversions around the Kirtling Street site would result in an extension of journey of 20m (based on a walking speed of 1.3m/sec) and a journey time increase of less than one minute. This results in a low adverse impact on pedestrian delay for those walking along the eastern side of Kirtling Street. Other pedestrian movements in the area would experience a negligible impact.

12.5.12 With regards to pedestrian amenity the closure of the western and northern Kirtling Street footway would not result in pedestrians having to make additional road crossings along the diversion route for the Thames Path. The impact magnitude for pedestrian amenity would therefore be classified as medium adverse using the criteria set out in Vol 2 Section 12.

12.5.13 The impact on pedestrian accidents and safety would be medium adverse using the criteria set out in Vol 2 Section 12. This is on the basis that pedestrian flows would be more than 240 people per hour and there would be up to 25 two way construction HGV movements an hour with pedestrians having to cross the path of construction vehicles at site access points.

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 There are no designated cycle routes along Kirtling Street or Cringle Street. The designated London Cycle Network 4 which routes along Nine Elms Lane (A3205) provides wide footway/cycleways with capacity to accommodate additional cycle movements.

12.5.16 Cyclists using the highway would experience an additional delay to journey time as a result of the construction works at the Kirtling Street site. The effect on journey times is outlined under the highway operation and network assessments, paras. 12.5.47-12.5.49 and would be an increase of a maximum of some ten seconds over that in the construction base case occurring for cyclists turning out of Cringle Street in the PM peak hour. This represents a negligible impact using the criteria set out in Vol 2 Section 12 as there are more than four construction vehicle movements per hour.

12.5.17 With regard to accidents and safety cyclists using the Thames Path would be required to cross three site accesses as a result of the diversions and there would be an increase in construction traffic flow of between four and 20 two-way HGV movements per hour. Overall this represents a low adverse impact on accidents and safety for cyclists.

Bus routes and patronage

12.5.18 Construction vehicles serving the site may affect some bus journey times along Nine Elms Lane (A3205) and its junctions with Kirtling Street / Battersea Park Road (A3205) / New Covent Garden access road and Cringle Street / Nine Elms Parkside access road and within the wider area. The effect on journey times is detailed under the highway operation and network assessment (see paras. 12.5.47-12.5.49) and would be an increase of a maximum of approximately two seconds on Nine Elms Lane (A3205). This represents a negligible impact.

12.5.19 It is expected that approximately 47 and 29 additional two-way worker trips would be made by bus during the AM and PM peak hours respectively, which would result in less than three and two additional worker trips per bus respectively (based on a service of 21 buses within a 640m walking distance during each of the AM and PM peak hours).

12.5.20 Based on the impact criteria outlined in Vol 2 Section 12 the additional worker trips made by bus in peak hours would have a negligible impact on bus patronage.

London Underground and National Rail services and patronage

12.5.21 No Underground or rail stations are directly adjacent to the site and therefore none would be directly affected by the construction site development. However, it is anticipated that approximately 147 construction workers and labourers in the AM peak hour and 91 in the PM peak hour would use London Underground or National Rail services to access the site. This would be split into 79 and 49 additional person trips on National Rail services and 68 and 42 additional person trips on London Underground services in each of the AM and PM peak hours respectively.

12.5.22 On London Underground services this equates to less than one person per train during the AM and PM peak hours based on a frequency of up to 42 trains during the peaks. On National Rail services there would be less than one additional passenger per train based on a frequency of over 100 trains during the peaks serving the site from all train stations as discussed in paras. 12.4.31-12.4.38.

12.5.23 Based on the quantitative assessment of patronage and the impact criteria on rail patronage in Vol 2 Section 12 this would result in a negligible impact on London Underground and National Rail patronage.

River passenger services and patronage

12.5.24 There are no river passenger services in the immediate vicinity of the Kirtling Street site and therefore it is not expected that the transport of construction materials to and from the site by river would directly affect such services.

12.5.25 During construction it is anticipated that less than 1% of construction workers and labourers would use river services to access the construction site. As this represents one additional journey per river service in the AM peak hour calling at St George Wharf Pier, the impact on river passenger services would be negligible using the criteria for river passenger service patronage in Vol 2 Section 12.

River navigation

12.5.26 This section addresses the effects on river navigation and access in the vicinity of the Kirtling Street site. The wider effects of transporting construction materials by river from a number of sites within the project are dealt with in Vol 3 Section 12.

12.5.27 During construction it is intended that the main tunnel excavated material (export) and main tunnel secondary lining aggregate (import) would be transported by barge. For assessment it is taken as 90% of these materials are by river to take into account periods where river transport is unavailable or the material is unsuitable. The peak number of barge movements would occur in Site Year 3 of construction with a daily average of eight barge movements a day. Barges would be hauled by tugs which may haul two barges at a time where possible and depending on barge size and mooring conditions. The number of transit movements required on the river may therefore be lower than the number of individual barge movements.

12.5.28 A temporary jetty would be provided to serve the Kirtling Street site and the transfer of excavated material to barges. This would be located to the northeast of Cringle Dock.

12.5.29 The temporary jetty would affect access to Cringle Dock which is used by the Western Riverside Waste Authority to transport containers from the waste transfer station. The presence of the temporary jetty to the northeast of the dock could cause minor delays to barges as they may need to undertake additional manoeuvres to access the dock and may have to wait if other barges are docking at or leaving the temporary jetty.

12.5.30 The Cemex concrete batching facility adjacent to the site is to continue operations during construction. Access from this facility to Kirtling Wharf and jetty would be affected by the temporary jetty serving the Kirtling Street site. This could lead to minor delays to barges docking and leaving the jetty.

12.5.31 As the number of barge movements at the Kirtling Street site is expected to be between five and eight it is anticipated that impact on any other vessels using the river in the vicinity of the site would be low adverse based on the criteria set out in Volume 2.

12.5.32 It is noted that a separate *Navigational Issues and Preliminary Risk Assessment* has been undertaken for the temporary construction works and barges to be used at the Kirtling Street site. This is reported separately outside of the *Environmental Statement* and *Transport Assessment* and will accompany the application.

Parking

12.5.33 As part of the Battersea Power Station development it is proposed to remove on-street parking along Kirtling Street and Cringle Street as mentioned in para. 12.4.97. This would provide adequate road width to allow construction vehicles to travel to the site access points.

12.5.34 As there would therefore be no change to parking due to the Thames Tideway Tunnel project at the Kirtling Street site compared to the construction base case there would be a negligible impact on parking.

Highway network and operation

12.5.35 The highway layout during construction (phases 1-3) plan (see separate volume of figures – Section 1) show the highway layout during of construction of the Kirtling Street site. The construction site areas would be accessed from Kirtling Street or Cringle Street either turning left or right from Battersea Park Road (A3205) or Nine Elms Lane (A3205) at the signalised junction. The sites are also bounded to the north and south by Cringle Street, where vehicles would egress using its priority junction with Nine Elms Lane (A3205).

12.5.36 Public traffic would not be permitted to access the northern and northwestern section of Kirtling Street which would be closed during the construction period.

12.5.37 The highway layout during construction vehicle swept path analysis (phases 1-3) plan (see Kirtling Street *Transport Assessment* figures) shows the swept path movements demonstrating that the construction vehicles would be able to safely enter and leave the site.

12.5.38 Construction lorry movements would be limited to the day shift only (08:00 to 18:00 Monday to Friday, 08:00 to 13:00 Saturday) except in exceptional circumstances when HGV and abnormal load movements could occur up to 22:00 on weekdays for large concrete pours and later at night with the agreement of the LB of Wandsworth.

12.5.39 Vol 14 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, which occurs during Site Year 3. The table also shows the other construction vehicle movements expected to be generated by the Kirtling Street site. The assessment has been based on 10% of the daily number of lorry journeys occurring in the peak hours, which has been agreed with TfL as a reasonable approach. It is recognised that it may be desirable to reduce the number of construction lorry movements in peak hours and the mechanisms for addressing this would form part of the *Traffic Management Plan*s which are required as part of the *Code of Construction Practice*.

Vol 14 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%*	192	0	19	19	0
Other construction vehicle movements**	134	6	6	6	6
Worker vehicle movements***	nominal	0	0	0	0
Total	**326**	**6**	**25**	**25**	**6**

** The assessment is 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 less than 1% of workers driving, on the basis that there would be no worker parking on site; on-street parking in the area is restricted; and Travel Plan measures would discourage workers from driving. In practical terms, this would be close to zero.*

12.5.40 To ensure the assessment of the highway network is robust it has been based on a combination of the peak hour of movements for construction lorries and other construction vehicles between 07:00 and 09:00 and 17:00 and 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.

12.5.41 An average peak flow of 326 vehicle movements a day is expected during the months of greatest activity during Site Year 3 of construction at this site. At other times in the construction period vehicle flows would be lower than this average peak figure.

12.5.42 The relevant impact criteria for determining the magnitude of impacts on highway network and operation are accidents and safety, road network delay and hazardous loads (as set out in Vol 2 Section 12).

12.5.43 It is anticipated that the changes to the highway layout would have a low adverse impact on accidents and safety as the site accesses would be located on Kirtling Street and Cringle Street and not directly on the strategic road network and because construction HGV movements would be in the category of four and 20 movements per hour.

12.5.44 It is assessed that potentially, two vehicle hazardous loads per week would be generated by this site and therefore the impact on the highway network in relation to hazardous loads would be medium adverse, based on the criteria set out in Vol 2 Section 12.

12.5.45 The local LinSig and PICADY 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 and development cases). The development case traffic flows (providing input to the LinSig and PICADY models) are shown on Vol 14 Figure 12.4.6 and Figure 12.4.7 (see separate volume of figures).

12.5.46 A summary of the construction assessment results for the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction for the weekday AM and PM peak hours is presented in Vol 14 Table 12.5.3 and Vol 14 Table 12.5.4.

12.5.47 The LinSig model results suggest that the junction would continue to operate within capacity with Battersea Park Road (A3205) reaching 80% in the AM peak hour and 82% in the PM peak hour. The increase in maximum delay per vehicle would be one second in the AM peak hour and two seconds in the PM peak hour. This represents a negligible impact on road network delay at this junction.

12.5.48 A summary of the construction assessment results for the Cringle Street / Nine Elms Lane (A3205) / Nine Elms Parkside access road junction for the weekday AM and PM peak hours is presented in Vol Vol 14 Table 12.5.5 and Vol 14 Table 12.5.6.

12.5.49 The model results show that the junction would continue to operate within capacity in the construction development case. The maximum increase in delay would be ten seconds in the PM peak hour for vehicles turning out of Cringle Street, with a corresponding increase in queue length of one vehicle. The ratio of flow to capacity for this movement would increase by 8% in the PM peak hour, which would be the maximum increase at this junction. Overall this would result in a negligible impact on road network delay at this junction, based on the impact criteria identified in Vol 2 Section 12.

Vol 14 Table 12.5.3 Transport – construction LinSig model outputs, AM peak hour

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Kirtling Street	Left	4	3%	3%	0%	0	0	0	58	58	0
	Right	52	37%	37%	0%	2	2	0	64	64	0
Nine Elms Lane (A3205)	Left / ahead	576	75%	75%	0%	14	15	+1	36	36	0
	Right / ahead	520	70%	73%	+3%	13	14	+1	36	37	+1
New Covent Garden Market	Left	96	72%	72%	0%	4	4	0	91	91	0
	Right / ahead	40	29%	29%	0%	1	1	0	62	62	0
Battersea Park Road (A3205)	Left / ahead	484	75%	76%	+1%	13	14	+1	41	42	+1
	Right	607	79%	80%	+1%	15	15	0	43	44	+1
			PRC						Total delay (PCU hours)		
Overall junction performance			13.3%	12.5%	-0.8%				28	28	0

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. Delay represents the mean delay per PCU. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs. Thames Tideway Tunnel project 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. 12.3.28.

Vol 14 Table 12.5.4 Transport – construction LinSig model outputs, PM peak hour

Approach	Movement	Flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			Base case	Devt case	Change	Base case	Devt case	Chang e	Base case	Devt case	Chang e
Kirtling Street	Left	6	5%	5%	0	0	0	0	59	59	0
	Right	43	31%	31%	0	1	1	+1	62	62	0
Nine Elms Lane (A3205)	Left / ahead	598	78%	79%	+1%	16	16	0	38	38	0
	Right / ahead	572	75%	77%	+2%	15	15	+1	37	39	+2
New Covent Garden Market	Left	93	70%	70%	0	4	4	0	88	88	0
	Right / ahead	33	24%	24%	0	1	1	0	60	60	0
Battersea Park Road (A3205)	Left / ahead	521	81%	82%	+1%	15	15	0	45	46	+1
	Right	579	80%	80%	0	16	16	0	43	43	0
			PRC						Total delay (PCU hours)		
Overall junction performance			10.8%	10.0%	-0.8%				30	30	+1

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 project 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. 12.3.28.

Vol 14 Table 12.5.5 Transport – construction PICADY model outputs, AM peak hour

Approach	Movement	Flow (vehs)	Weekday								
			AM peak hour (08:00-09:00)								
			RFC			Max. Queue (vehs)			Delay (seconds per veh)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Cringle Street	Left / ahead /right	83	36%	43%	+5%	1	1	0	29	34	+5
Nine Elms Lane (westbound) (A3205)	Right	2	1%	1%	0	0	0	0	19	19	0
Nine Elms Parkside	Left	5	2%	2%	0	0	0	0	17	17	0
Nine Elms Parkside	Right	3	4%	4%	0	0	0	0	50	52	+2
Nine Elms Lane (eastbound) (A3205)	Right	81	37%	37%	0	1	1	0	26	26	0

Notes: RFC represents Ratio of Flow to Capacity. Queue represents number of vehicles in queue. Delay represents the mean delay per vehicle.

Vol 14 Table 12.5.6 Transport – construction PICADY model outputs, PM peak hour

Approach	Movement	Flow (vehs)	Weekday								
			AM peak hour (17:00-18:00)								
			RFC			Max. Queue (vehs)			Delay (seconds per veh)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Cringle Street	Left / ahead / right	139	58%	66%	+8%	1	2	+1	39	49	+10
Nine Elms Lane (westbound) (A3205)	Right	3	2%	2%	0	0	0	0	20	20	0
Nine Elms Parkside	Left	4	2%	2%	0	0	0	0	18	18	0
Nine Elms Parkside	Right	2	3%	3%	0	0	0	0	60	64	+4
Nine Elms Lane (eastbound) (A3205)	Right	78	33%	33%	0	0	0	0	23	23	0

Notes:RFC represents Ratio of Flow to Capacity. Queue represents number of vehicles in queue. Delay represents the mean delay per vehicle.

Significance of effects

12.5.50 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 14 Table 12.4.3 and Vol 14 Table 12.4.4.

12.5.51 Vol 14 Table 12.5.7 sets out the effects on each receptor in the vicinity of the site.

Vol 14 Table 12.5.7 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 the Thames Path and the local highway network.	Moderate adverse effect on pedestrians. Minor adverse effect on cyclists	**Pedestrians:** • High sensitivity • Medium adverse impact on pedestrian amenity and accidents and safety • Low adverse impact on pedestrian delay • Due to the low and medium impact magnitudes, equates to a moderate adverse effect. **Cyclists**: • High sensitivity • Negligible impact on cycle delay • Low adverse impact accidents and safety. • Negligible and low adverse impacts equate to a minor adverse effect.
Private vehicle users (including taxis) in the area using the local highways or on-street parking.	Minor adverse effect on highway users Negligible effect on parking users	**Highway users:** • Medium sensitivity • Negligible impact on road network delay • Low adverse impact on accidents and safety • Medium adverse impact from hazardous loads • Due to mixture of negligible, low, medium and high

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		adverse impacts, equates to minor adverse effect. **Parking users:** • Medium sensitivity • No impact on on-street parking • Due to no impact, this equates to negligible effect.
Emergency vehicles using Kirtling Street, Cringle Street and Nine Elms Lane (A3205) / Battersea Park Road (A3205)	Minor adverse effect	• High sensitivity • Negligible impact on road network delay • Low adverse impact on accidents and safety • Medium adverse impact from hazardous loads • Due to mixture of negligible, low, medium and high adverse impacts, equates to minor adverse effect.
Marine emergency services	Negligible effect	• High sensitivity • Negligible effect on river navigation/moorings • Negligible impact equates to negligible effect
Bus users (passengers) travelling along Nine Elms Lane (A3205) / Battersea Park Road (A3205) and through the Vauxhall Gyratory.	Negligible effect	• Medium sensitivity • Negligible impact on network delay and patronage • Due to negligible impacts, equates to a negligible effect.
Public transport users using rail or river services within the area	Negligible effect	• Low sensitivity • Negligible impact on network delay and patronage • Due to negligible impacts, equates to a negligible effect.
River vessel operators	Minor adverse effect	• Medium sensitivity

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
including river passenger services.		• Negligible impact on patronage • Low adverse impact on river navigation • Due to negligible and low adverse impacts, equates to a minor adverse effect
Occupiers of Battersea Power Station, Riverlight, New Covent Garden Market and Embassy Gardens developments Residents of the houseboats at Tideway Village and Nine Elms Pier Users of Battersea Barge restaurant	Moderate adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Negligible effect on parking users	**Pedestrians**: • High sensitivity • Medium adverse impact on pedestrian amenity and accidents and safety • Low adverse impact on pedestrian delay • Due to the low and medium impact magnitudes, equates to a moderate adverse effect. **Cyclists**: • High sensitivity • Negligible impact on cycle delay • Low adverse impact on accidents and safety. • Due to negligible and low adverse impacts, equates to a minor adverse effect. **Highway users:** • Low sensitivity • Negligible impact on road network delay • Low adverse impact on accidents and safety • Medium adverse impact from hazardous loads • Overall minor adverse effect on highway users **Parking users:** • Medium sensitivity • No impact on on-street

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		parking • Due to no impact, this equates to negligible effect.
Users and operators of Cringle Dock Waste Transfer Station and Cemex concrete batching works	Minor adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Negligible effect on parking users	**Pedestrians:** • Low to medium sensitivity • Medium adverse impact on pedestrian amenity and accidents and safety • Low adverse impact on pedestrian delay • Given the sensitivity of the receptor, overall effect is considered to be minor adverse. **Cyclists:** • Low to medium sensitivity • Negligible impact on cycle delay • Low adverse impact on accidents and safety. • Overall effect is considered to be minor adverse. **Highway users:** • Low to medium sensitivity • Negligible impact on road network delay • Low adverse impact on accidents and safety • Medium adverse impact from hazardous loads • Overall effect is considered to be minor adverse. **Parking users:** • Medium sensitivity • No impact on on-street parking • Due to no impact, this equates to negligible effect.

Sensitivity test for programme delay

12.5.52 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.

12.5.53 If the overall programme were to be delayed by approximately a year, the implications in relation to the transport effects would be as follows:

a. It is unlikely that the effects on pedestrians and cyclists would change. Over the course of one year, it is unlikely that pedestrian or cycle traffic in the vicinity of the project site would increase by a sufficient amount to change the magnitude of impacts or the significance of effects reported, nor that the arrangements for pedestrian route diversions would be any different to those currently proposed

b. Effects on public transport are unlikely to change as the rate of public transport patronage growth is relatively low and over the course of one year, any reduction in spare capacity on existing public transport networks would be small. Additionally, there is a general trend towards the enhancement of the public transport network through the provision of additional bus, rail and river services in order to meet future demand and accommodate future patronage growth. The transport assessment typically indicates that the additional public transport patronage arising from Thames Tideway Tunnel project sites would be small and not significant in the context of the capacity available on the wider networks

c. Effects on river navigation and access would not be significantly different as the rate of change in patterns of river usage is comparatively small

d. 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 Kirtling 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

e. Based on the site development schedule (see Vol 14 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 the assessment would be partially complete and occupied. However, it is not expected that new receptors would experience any different effects to those receptors which have been assessed above; rather it would be a case of the potential for some additional receptors to experience the same effects that have already been identified.

12.6 Operational effects assessment

12.6.1 This section summarises the findings of the assessment undertaken for Year 1 of operation at the Kirtling 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 other support vehicles required for access to the shaft and tunnel every ten years.

12.6.3 The assessment of the operational phase has therefore been limited to the physical issues associated with accessing the site from the highway network.

12.6.4 The operational assessment has taken into consideration those elements that would be affected, which comprise the short-term impacts on the highway layout and operation when maintenance visits are made to the site.

Highway layout and operation

12.6.5 During the operational phase, the site would be accessed from Kirtling Street via its junction with Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road from the eastbound carriageway. The permanent highway layout plan (see separate volume of figures – Section 1) shows the highway layout during the operational phase.

12.6.6 For routine three or six monthly inspections vehicular access would be required for light commercial vehicles, typically a transit van. On occasion there may also be a need for flatbed vehicles to access the site.

12.6.7 During ten-yearly inspections an area 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 path analyses have been undertaken for the largest vehicles expected to access the site: 11.36m mobile cranes, 10m rigid articulated vehicle and 10.7m articulated vehicle and a 13.6m mobile crane. The permanent highway layout plan vehicle swept path analysis plans (see Kirtling Street *Transport Assessment* figures) show the swept path movements during operation demonstrating that the maintenance vehicles would be able to safely enter and leave the site.

12.6.8 When larger vehicles are required to service the site there may be some temporary, short-term delay to other road users while manoeuvres are made. However it is anticipated that the arrival of large vehicles would normally be scheduled to take place outside of the peak hours to minimise the effect on the local highway network.

12.6.9 In accordance with the criteria outlined in Vol 2 Section 12 during the routine inspections of the operational site there would be a negligible impact on road network delay.

12.6.10 Taking into consideration the sensitivities of the receptors affected during the operational phase (private vehicle users, emergency vehicles and occupiers/residents of Battersea Power Station, Riverlight, New Covent Garden Market, Embassy Gardens, houseboats at Tideway Village and Nine Elms Pier developments) this would result in a **negligibl**e effect on road network delay and operation.

Sensitivity test for programme delay

12.6.11 If the opening year of the Thames Tideway Tunnel project were to be delayed by approximately one year, the results of the operational assessment would not be materially different to the assessment findings reported above.

12.7 Cumulative effects assessment

Construction effects

12.7.1 As listed in para. 12.3.7, there are a number of developments in the vicinity of the Kirtling Street site that would be under construction in Site Year 3 of construction. This suggests that there are cumulative effects to assess for the construction development case. However, as paras. 12.3.9 to 12.3.10 explain, the TfL HAMs which have been used in the assessment already take account of population and employment growth forecasts in London.

12.7.2 In addition, specific allowance has been made in the local highway modelling for the construction trips generated by the committed developments in para. 12.3.7, where that information is available.

12.7.3 This approach addresses a number of uncertainties around the actual timescale for implementation of each of the committed developments and thus inherently addresses cumulative effects within the assessment of construction effects reported in Section 12.5. The effects on transport would therefore remain as described in that section. This would also be the case if the programme for the Thames Tideway Tunnel project were delayed by approximately one year.

Operational effects

12.7.4 As indicated in the site development schedule (see Vol 14 Appendix N) and as identified in liaison with TfL and LB Wandsworth, the developments stated in paras. 12.3.20 and 12.3.21 are in the vicinity of the Kirtling Street site would be under construction or operational by Year 1 of operation.

12.7.5 However, as maintenance trips to the Kirtling Street site would be low and the trips from the developments listed above are already taken into account within the assessment, there is no need for a cumulative assessment on transport and the effects 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

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 Kirtling 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

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 construction effects remain as described in Section 12.5. All residual effects are presented in Section 12.10.

Operational effects

12.9.2 As no mitigation measures are proposed the residual operational effects remain as described in Section 12.6. All residual effects are presented in Section 12.10.

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Road (A3205) and through the Vauxhall Gyratory.				
Public transport users using rail or river services within the area	• Some additional patronage from construction workers.	Negligible effect	None	Negligible effect
River vessel operators including passenger services	• Movement of construction barges at temporary jetty • Delay to journey time	Minor adverse effect	None	Minor adverse effect
Occupiers of Battersea Power Station, Riverlight, New Covent Garden Market and Embassy Gardens developments Residents of the houseboats at Tideway Village and Nine Elms Pier Users of Battersea Barge restaurant	• Movement of large construction vehicles • Delay to journey time • No effect on on-street parking	Moderate adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Negligible effect on parking users	None	Moderate adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Negligible effect on parking users
Users and operators of Cringle Dock Waste Transfer Station and Cemex concrete batching works	• Movement of large construction vehicles • Delay to journey time for visitors and staff on the highway network	Minor adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect	None	Minor adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
		on highway users Negligible effect on parking users		highway users Negligible effect on parking users

Vol 14 Table 12.10.2 Transport – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Private vehicle users (including taxis) in the area using the local highways	• Occasional maintenance trips resulting in some temporary, short-term road network delay and parking suspensions.	Negligible effect	None	Negligible effect
Emergency vehicles using Kirtling Street, Cringle Street and Nine Elms Lane (A3205) / Battersea Park Road (A3205)	• Occasional maintenance trips resulting in some temporary, short-term road network delay and parking suspensions.	Negligible effect	None	Negligible effect
Occupiers of Battersea Power Station, Riverlight, New Covent Garden Market, Embassy Gardens and houseboats at Tideway Village and Nine Elms Pier	• Occasional maintenance trips resulting in some temporary, short-term road network delay.	Negligible effect	None	Negligible effect

12.10 Assessment summary

Vol 14 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 the Thames Path and local highway network.	• Loss of footway • Local diversions (increased walking distance) • Additional road crossings required	Moderate adverse effect on pedestrians Minor adverse effect on cyclists	None	Moderate adverse effect on pedestrians Minor adverse effect on cyclists
Private vehicle users (including taxis) in the area using the local highways or on-street parking	• Changes to road and access routes • Movement of large construction vehicles • No impact on on-street parking	Minor adverse effect on highway users Negligible effect on parking users	None	Minor adverse effect on highway users Negligible effect on parking users
Emergency vehicles using Kirtling Street, Cringle Street and Nine Elms Lane (A3205) / Battersea Park Road (A3205)	• Changes to road and access routes • Movement of large construction vehicles	Minor adverse effect	None	Minor adverse effect
Marine emergency services	• Additional barge movements on the River Thames	Negligible effect	None	Negligible effect
Bus users (passengers) travelling along Nine Elms Lane (A3205)/ Battersea Park	• Some additional patronage from construction workers.	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] The estimates are derived from study team calculations that use the arrival and departure times for piers published in TfL River Bus and Tour timetables (http://www.tfl.gov.uk/modalpages/2648.aspx) and information on barge movements obtained from barge operators and commercial users.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Thames Water

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 13: Water resources - groundwater

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

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling 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 Kirtling Street site.

13.1.2 The proposed development has the potential to affect groundwater due to:

a. dewatering of aquifer units
b. creation of pathways for pollution
c. obstruction to groundwater flows
d. seepage into and out of the main tunnel shaft during operations.

13.1.3 The groundwater assessment at this site should be read in conjunction with the supporting Volume 14 Appendix K (K.1 – K.9) and the land quality assessment (Section 8 Land quality).

13.1.4 The nearest receptor to Kirtling Street is the Thames Water Utilities public water supply abstraction source. A Source Protection Zone[i] is designated for this abstraction which encompasses the Kirtling Street site. There are also five other abstractions from the Chalk and one from River Terrace Deposits within the assessment area. The River Terrace Deposits (or upper aquifer) is a secondary aquifer[ii]. The Chalk, in combination with the Thanet Sand and Upnor Formation forms the lower aquifer, which is a principal aquifer [iii].

13.1.5 The construction of the main tunnel shaft would require the drawdown of groundwater levels ahead of construction taking place at Kirtling Street. This would require dewatering of the underlying lower aquifer at Kirtling Street, from which the Thames Water and several other private individuals abstract water.

13.1.6 An assessment of project-wide level environmental effects on groundwater is presented in Volume 3 Project-wide assessment.

13.1.7 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).

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[i] Source Protection Zone – which are designed to safeguard groundwater resources from potentially polluting activities.

[ii] 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)

[iii] Principal aquifer – a geological stratum that exhibits high inter-granular and /or fracture permeability (was previously referred to as a major aquifer)

13.1.8 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling Street Figures).

13.2 Proposed development relevant to groundwater

13.2.1 The proposed development has been 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 Kirtling Street site, relevant to groundwater assessment, would include:

a. A main tunnel shaft of approximately 30m internal diameter (ID), and approximately 48m deep (or 56.98mATD[iv] based on an assumed ground level of 104.5mATD) (excluding an approximately 8m thick base slab once constructed).

b. Launch of the two tunnel boring machines (TBM) would take place at approximately 57mATD into the Lambeth Group at this site. It is anticipated that this would require under draining of the Chalk to depressurise the Lambeth Group and would be required for a period of up to 12 months.

13.2.3 The proposed methods of construction for these elements of the site are described in Section 3 of this volume and approximate duration of construction and depth are also contained in Vol 14 Table 13.2.1.

Vol 14 Table 13.2.1 Groundwater – methods of construction

Design element	Method of construction	Construction periods (years)	Construction depth
Main tunnel shaft	Diaphragm wall[v] and dewatering	> 1*	Deep**
Launch of the two TBMs	Controlled launch would involve localised depressurisation of the Lambeth Group	> 1	Deep**

** The site is a double drive site and would be used for construction purposes for up to 6 years.*

[iv] 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.

[v] Diaphragm wall – a sub-surface structure installed to support the required excavation and to cut off potential inflows of groundwater typically formed of reinforced concrete. This barrier would extend down by up to 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.

***In terms of construction depth - deep (means >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 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 of water quality monitoring, would be applied to abstraction licences thought to be at risk.

c. Monitoring arrangements for dewatering permits and any permits required on change of licensing regulations would be developed in liaison with the EA (see also the groundwater monitoring strategy in Vol 3 Appendix K.1).

d. 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*.

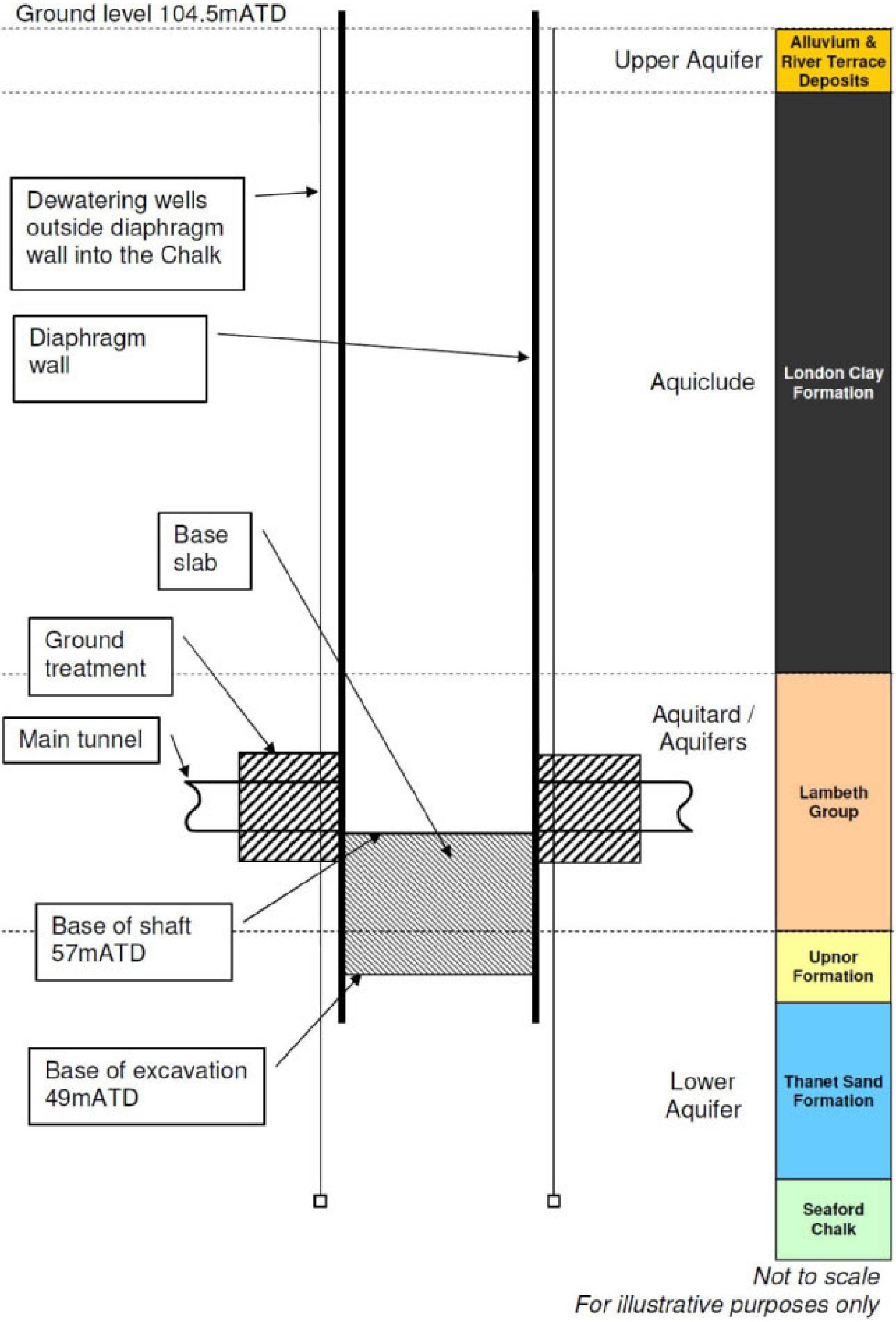
Other measures during construction

13.2.6 The depth of main tunnel shaft means that it would extend into the Lower Mottled Beds of the Lambeth Group (see Vol 14 Table 13.4.1 and Vol 14 Appendix K.1), with the base slab extending down into the Upnor Formation.

13.2.7 The method of construction for the main tunnel shaft would involve building a concrete lining around the shaft (constructed using diaphragm wall techniques). There would be pumping of groundwater external to the diaphragm wall, in order to prevent potential heave (upward movement) at the base of the shaft. It is expected that dewatering wells would be drilled into the Chalk of the lower aquifer around the outside periphery of the diaphragm walled shaft and pumped to lower the pressure (see

Vol 14 Plate 13.2.1). It is expected that the depressurisation of the Lambeth Group would best be achieved by carrying out dewatering of the Chalk and under-draining (drawing down water from any overlying layers) of the Upnor Formation and Thanet Sands. The periods when pumping would be required would be during construction of the main tunnel shaft (approximately 12 months during which the construction of the base slab would take up to eight months and would represent the peak period of dewatering) and for the break out of the shaft for the tunnel boring machine for the main tunnel.

Vol 14 Plate 13.2.1 Groundwater – Schematic of a diaphragm wall - externally dewatered



13.2.8 In order to build the main tunnel shaft, water levels in the Upnor Formation (upper part of the lower aquifer), would be reduced from approximately 77mATD to 49mATD, resulting in a design drawdown of around 28m external to the diaphragm wall. A corresponding reduction in pressure inside the diaphragm wall would also occur. It is estimated that the average rate of dewatering at Kirtling Street would be approximately 440m^3/d. This rate is in part due to the transmissivity[vi] of the Chalk at Kirtling Street at around 450m^2/d, the use of external dewatering and the method of construction involving separate dewatering for the base slab. The individual element of the construction which would require the greatest dewatering is the construction of the base slab (with an estimated peak dewatering of 2,700m^3/d) which would take approximately eight months. With the dewatering of the base slab not included the average dewatering would be approximately 400m^3/d.

13.2.9 No dewatering of the upper aquifer would be anticipated as the diaphragm wall would cut off any inflows from the River Terrace Deposits.

13.2.10 It is anticipated that ground treatment[vii] may be required within the Lambeth Group to facilitate the TBM break out of the main tunnel shaft.

Operation

13.2.11 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. It outlines the future monitoring and actions in the event of trigger levels being exceeded.

13.3 Assessment methodology

Engagement

13.3.1 Vol 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. There have been no site-specific comments relevant to the Kirtling Street site for the assessment of groundwater.

Baseline

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

13.3.3 The baseline describes receptors within a 1km radius of the sites during both construction and operation.

13.3.4 The effects on groundwater may however extend beyond a kilometre depending on the hydrogeological setting and the method of construction

[vi] Transmissivity - the ability of rock to transmit water which is a function of its permeability and thickness

[vii] Ground treatment – stabilisation of soils/rocks by injection of grouts and or freezing techniques.

used. These effects are considered of wider regional significance and are assessed in the project-wide assessment (see Vol 3).

Construction

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

13.3.6 The land quality assessment has highlighted that there may be a need to remediate this site prior to Site Year 1, this would be specified following a risk assessment being undertaken (Vol 14 Section 8.2). For the purposes of the groundwater assessment it has been assumed that the Site Year 1 would represent the first year when any impacts on groundwater occur. Dewatering would take place outside the diaphragm wall; the volumes of dewatering would be at their greatest at the end of the first year (and running on into the beginning of Year 2). The baseline is not anticipated to change substantially between 2011 and the Site Year 1 of construction (2016) and so baseline data from 2011 have formed the basis (base case) for the construction assessment.

13.3.7 A number of proposed developments which are likely to be complete and operational before commencement of construction have formed part of construction base case.

13.3.8 The developments considered as part of the base case and those included in the cumulative effects assessment are presented in Vol 14 Table 13.3.1. The developments relevant to groundwater are those which contain basements or underground structures, ground source heat pumps (GSHPs) and Sustainable Drainage Systems (SuDS).

Vol 14 Table 13.3.1 Groundwater – construction base case and cumulative assessment developments (2016)

Development	Component or receptor relevant to groundwater	Construction base case	Cumulative effect assessment	Comments (if required)
1-9 Bondway and 4-6 South Lambeth Place	Basement*	✓	✗	n/a
Battersea Plant, Nine Elms Lane Goods Yard, Cringle Street	None	✓	✗	n/a
Battersea Power Station	Basement* SuDS*	Phase 1 and Phase 2 complete	Phase 3 under construction	Abstraction **28/39/42/0074 already considered in current base case.
Chelsea Barracks	Basement*	✗	✓	n/a

Development	Component or receptor relevant to groundwater	Construction base case	Cumulative effect assessment	Comments (if required)
Chelsea Bridge Road				
Embassy Gardens, land to the south of Nine Elms Lane comprising DHL Depot and 1-12 Ponton Road and 51 Nine Elms Lane	Basement* SuDS*	Buildings A09, A10, & A11 complete	Buildings A01, A02, A03, A04, A05 & A07 under construction	n/a
Island Site Vauxhall Cross	Basement*	✘	✓	n/a
Land at St Georges Wharf (Vauxhall Tower)	Basement* GSHP**	✓	✘	n/a
Marco Polo House, 346 Queenstown Road	Basement*	Phase 1a complete	Phases 1b and 2 under construction	n/a
Market Towers	Basement*	✓	✘	n/a
New Covent Garden Market	Basement*	✘	B1, B2, B3, B4, B5 & B6 under construction	n/a
Nine Elms Pier	None	✓	✘	n/a
Nine Elms Sainsbury's, Wandsworth Road	Basement*	✓	✘	n/a
Northern Line Extension	Underground structures*	✘	✓	n/a
Post Office Depot, South London Mail Centre Nine Elms Lane	Basement*	✘	Plots C & D under construction	n/a
Riverlight, Tideway Industrial Estate	Basement* GSHP**	90% complete, assumed blocks B, C, D, E and F complete	Block A under construction	n/a
US Embassy - Land on south side of Nine Elms Lane incorporating Ponton Road	None	✓	✘	n/a
Vauxhall Sky Gardens, 143-161 Wandsworth	Basement*	✓	✘	n/a

Development	Component or receptor relevant to groundwater	Construction base case	Cumulative effect assessment	Comments (if required)
Road				

** Relevant to the upper aquifer*
*** Relevant to the lower aquifer*
Symbols ✓ applies ✗ does not apply

13.3.9 Section 13.5 details the likely significant effects arising from the construction at the Kirtling Street site. Other Thames Tideway Tunnel project sites which could give rise to additional effects on groundwater resources are Blackfriars Bridge Foreshore, which would be another site with significant external dewatering, although this site is some distance away. Other nearer sites to Kirtling Street would only require very small amounts of dewatering from the lower aquifer. 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 Kirtling Street, following the methodology set out in Vol 2 Section 12.

Operation

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

13.3.11 The assessment year applied to the operational assessment is Year 1 of operation. The baseline is not anticipated to vary significantly by the start of the operational phase in 2023; and therefore, baseline data from 2011 have formed the basis for the operational assessment.

13.3.12 The developments considered as part of the operational base case and the cumulative effects assessment, are detailed in Vol 14 Table 13.3.2. The receptors relevant to groundwater include basements, GSHPs and SuDS.

Vol 14 Table 13.3.2 Groundwater – operational assessment (2023)

Development	Component or receptor relevant to groundwater	Operational base case	Cumulative effect assessment	Comments (if required)
1-9 Bondway and 4-6 South Lambeth Place	Basement*	✓	✗	n/a
Battersea Plant, Nine Elms Lane Goods Yard, Cringle Street	None	✓	✗	n/a
Battersea Power Station	Basement* SuDS*	Phase 1, 2, 3, 4 and 6 complete	Phase 5 and 7 under construction.	Abstraction **28/39/42/0074 already considered in

Development	Component or receptor relevant to groundwater	Operational base case	Cumulative effect assessment	Comments (if required)
				current base case.
Chelsea Barracks Chelsea Bridge Road	Basement*	✓	✗	n/a
Embassy Gardens, land to the south of Nine Elms Lane comprising DHL Depot and 1-12 Ponton Road and 51 Nine Elms Lane	Basement* SuDS*	✓	✗	n/a
Island Site Vauxhall Cross	Basement*	✓	✗	n/a
Land at St Georges Wharf (Vauxhall Tower)	Basement* GSHP**	✓	✗	n/a
Marco Polo House, 346 Queenstown Road	Basement*	✓	✗	n/a
Market Towers	Basement*	✓	✗	n/a
New Covent Garden Market	Basement*	Buildings B1, B2, B3, B4, B5 and B6 and site entrance complete	Building T1, T2 and T3 under construction	n/a
Nine Elms Pier	None	✓	✗	n/a
Nine Elms Sainsbury's, Wandsworth Road	Basement*	✓	✗	n/a
Northern Line Extension	Underground structures*	✓	✗	n/a
Post Office Depot, South London Mail Centre Nine Elms Lane	Basement*	Plots A, B, C & D complete	Plots E, F & G under construction	n/a
Riverlight, Tideway Industrial Estate	Basement* GSHP**	✓	✗	n/a
US Embassy - Land on south side of Nine Elms Lane incorporating Ponton Road	None	✓	✗	n/a

Development	Component or receptor relevant to groundwater	Operational base case	Cumulative effect assessment	Comments (if required)
Vauxhall Sky Gardens, 143-161 Wandsworth Road	Basement*	✓	✗	n/a

** Relevant to the upper aquifer*
*** Relevant to the lower aquifer*
Symbols ✓ applies ✗ does not apply

13.3.13 Section 13.6 details the likely significant effects arising from the operation at the Kirtling Street site. There are no other Thames Tideway Tunnel sites which could give rise to additional effects on groundwater resources within the assessment area for the Kirtling Street site during the operational phase and so no other Thames Tideway Tunnel project sites are considered in this assessment.

Assumptions and limitations

Assumptions

13.3.14 The construction assumptions relevant to this site are presented in section 13.2.

13.3.15 The assessment of dewatering in Section 13.5 is based on a quantitative assessment of dewatering on the lower aquifer using the best available hydraulic property information from the EA's London Basin groundwater model. The hydraulic properties for the Chalk obtained from this model include an average transmissivity value of approximately $450m^2/d$ (EA and ESI, 2010)[3] and a storativity[viii] value of approximately 1×10^{-4} at the Kirtling Street site (see Vol 2 Section 12).

13.3.16 The average amount of pumping required from around the diaphragm wall at the site is assumed to be approximately $440m^3/d$.

13.3.17 Other nearby sites to Kirtling Street, including Heathwall Pumping Station, Albert Embankment Foreshore, Chelsea Embankment Foreshore, Victoria Embankment Foreshore and Cremorne Wharf Deport are assumed to have small amounts of dewatering of less than 200 m^3/d.

13.3.18 The assessment of obstruction effects in Sections 13.5 and 13.6 is based on estimated hydraulic gradient[ix] of 0.004 in the upper aquifer across the site.

13.3.19 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 north. The groundwater flow direction around Kirtling Street is anticipated to be influenced by the nearby Thames Water source to the west.

[viii] Storativity – the volume of water released for a unit change in water level (in a confined aquifer)

[ix] Hydraulic gradient – the slope of the water table which drives groundwater movement

13.3.20 The groundwater flow in the River Terrace Deposits, the upper aquifer, is anticipated to be to the north, towards the river.

13.3.21 This assessment has assumed that the shaft would have a design criterion to limit the rate of seepage of $1l/m^2/d$ (see Vol 2 Appendix K.3).

13.3.22 The assessment of dewatering has considered the impacts of pumping from the Chalk during the construction of the base slab of the shaft and the launch chambers for the TBMs. This means that the figures presented in the assessment (peak dewatering of $2,700m^3/d$ and an average of $440m^3/d$) are likely to be at top end of a range of predicted dewatering volumes. Estimates of the dewatering required may be lower than this if instead of dewatering the Chalk and under-draining the Thanet Sand, that dewatering takes place instead from the Thanet Sands.

13.3.23 The main tunnel shaft construction involving a diaphragm wall would contain an effective seal with the surrounding ground, thereby ensuring no pathway for groundwater contamination to occur.

13.3.24 For the purposes of this assessment it is assumed that no ground treatment would be required.

13.3.25 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.

13.3.26 For the purposes of this assessment, deep refers to greater than 10m below ground level.

Limitations

13.3.27 No site-specific pumping tests have yet been undertaken as part of the ground investigation. In the absence of site-specific hydrogeological data, published sources of hydrogeological information have been used in this assessment (see Vol 14 Appendix K.2).

13.3.28 Groundwater level data available for this assessment is limited, with monitoring data typically available from one borehole (or monitoring horizon) within the upper aquifer. This means 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.

13.3.29 Groundwater quality data available at this site is also limited.

13.3.30 Despite the limitations identified above, the assessment, which uses the best available information, is considered robust

13.4 Baseline conditions

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

13.4.2 This section of the report is supported by Vol 14 Appendix K.1 – K.9.

Current baseline

Hydrogeology

13.4.3 The main tunnel shaft would pass through Made Ground, Alluvium, River Terrace Deposits, London Clay, Harwich Formation and the Lambeth Group. The superficial and solid geology in the vicinity of the site, as published by the British Geological Survey (BGS)[5], is shown in Vol 14 Figure 13.4.1 and Vol 14 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 lower aquifer is comprised of the Upnor Formation, Thanet Sands and Chalk form. The lower aquifer is classified as a principal aquifer.

13.4.5 Geological boreholes were drilled during 2009 in the vicinity of the Kirtling Street site and in 2012, five shallow boreholes were drilled on site. The depths and thicknesses of the geological layers are summarised in Vol 14 Table 13.4.1.

Vol 14 Table 13.4.1 Groundwater – anticipated ground conditions/hydrogeology

Formation	Top elevation* (mATD)	Depth (m)	Thickness (m)	Hydrogeology
Made Ground	104.40	0.00	4.50***	Confining layer
Alluvium**	99.90	4.50	1.40	
River Terrace Deposits	98.40	6.00	1.90****	Upper aquifer
London Clay				Aquiclude
B	96.60	7.80	7.20	
A3ii	89.40	15.00	9.92	
A3i	79.48	24.92	2.35	
A2	77.13	27.27	11.90	
Harwich Formation	65.23	39.17	0.65	Aquitard/ aquifer
Lambeth Group				Aquitards/ aquifers
USB	64.58	39.82	1.20	
UMB	63.38	41.02	3.40	
LtB/LSB	59.98	44.42	2.60	
LMB	57.38	47.02	6.10	
UPN (Gv)	51.28	53.12	1.00	Lower aquifer
UPN	50.28	54.12	2.88	
Thanet Sand	47.40	57.00	9.50	
Seaford Chalk	37.90	66.50	Not proven	

** Based on an assumed ground level of 104.40mATD*
*** Alluvium was not present in ground investigation boreholes drilled on site*
**** The Made Ground was 0.9m and 3m thick at the on site boreholes*
***** The River Terrace Deposits were between 6m and 8.9m thick at the on-site boreholes*
USB–Upper Shelly Beds; UMB–Upper Mottled Beds; LtB–Laminated Beds; LSB-Lower Shelly Beds; LMB-Lower Mottled Beds; UPN (Gv)-Upnor Formation (Gravel); UPN-Upnor Formation

13.4.6 Groundwater inflows may be expected during excavation of the shaft within the Laminated Beds (LtB) (relatively large volumes), within the Upper Mottled Beds (UMB) (relatively small inflows) and within the Upnor Formation (potentially substantial volumes).

Groundwater level monitoring

13.4.7 Groundwater level monitoring has been undertaken at a number of boreholes across the assessment area (1km radius from the site). In addition, the EA has a regional network of monitoring boreholes, mainly within the lower aquifer, across London with groundwater level records available dating back over 50 years.

13.4.8 The information on groundwater levels for this assessment has been collected from three ground investigation boreholes (SA1084, PR1081 and SA1082) located within the assessment area (between 70 and 140m from the site). The locations are shown in Vol 14 Figure13.4.3 (see separate volume of figures). These boreholes have response zones[x] in the River Terrace Deposits, Seaford Chalk and Thanet Sands, and are monitoring groundwater levels in both the upper and lower aquifer. Vol 14 Table 13.4.2 summarises the minimum, average and maximum water levels at the three ground investigation boreholes.

Vol 14 Table 13.4.2 Groundwater – water level summary

Borehole ID	Formation	Average water level (mATD)	Minimum water level (mATD)	Maximum water level (mATD)
SA1084	River Terrace Deposits	100.35	100.20	100.55
SA1082	Thanet Sands	75.49	68.97	79.27
PR1081	Seaford Chalk	73.87	68.28	78.59
TQ27/334	Chalk	70.80	57.33	79.65

13.4.9 The recorded water levels in the River Terrace Deposits at SR1084 suggest that the upper aquifer is confined[xi] beneath the overlying Made Ground and Alluvium at this site.

[x] Response zone - the section of a borehole that is open to the host strata (EA, 2006)
[xi] Confined - a term used to describe an aquifer in which water is held under pressure, such that groundwater in a borehole penetrating a confined aquifer would rise to a level above the top of the aquifer

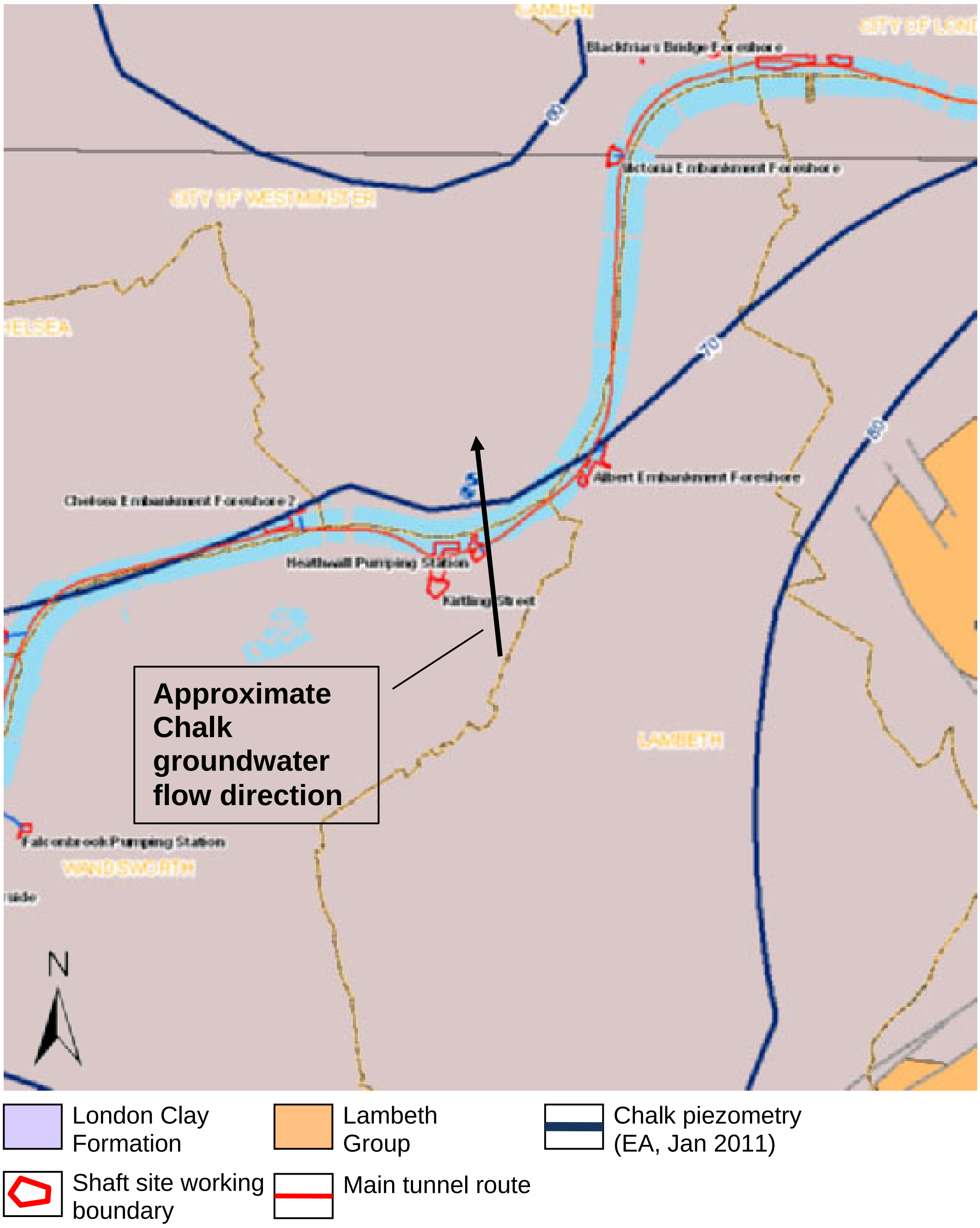
13.4.10 The recorded water levels in the Seaford Chalk and the Thanet Sands at PR1081 and SA1082 respectively show similar fluctuations, suggesting that these units are in hydraulic continuity at this location. The water levels remain above the top of the lower aquifer (Upnor Formation, Thanet Sands and Chalk) at 51.28mATD, indicating that the lower aquifer is confined beneath the overlying Lambeth Group and London Clay Formation at this site.

13.4.11 Further detail on water level monitoring is provided in Vol 14 Appendix K.3.

13.4.12 The EA produces an annual regional groundwater contour map (piezometry) of the Chalk, showing a snap-shot of groundwater flows in time[6]. The January 2011 map indicates that the regional direction of groundwater flow (perpendicular to groundwater contours) at this point in time was north in the Chalk around the Kirtling Street site (see Vol 14 Plate 13.4.1). However, it is likely that the nearby Chalk abstractions (see para. 13.4.16) may influence the direction of groundwater flow locally beneath the site to be towards the west instead. The location of the closest EA groundwater level monitoring borehole, and its respective hydrograph, is shown in Vol 14 Figure 13.4.4 (see separate volume of figures).

13.4.13 There is one monitoring borehole within the River Terrace Deposits; therefore it is not possible to accurately determine the direction of groundwater flow in these deposits. However, it is likely that given the close proximity of the site to the River Thames, that the direction of groundwater movement within these shallow deposits would be towards the north and this has been assumed in this assessment.

Vol 14 Plate 13.4.1 Groundwater – Chalk groundwater level contour map



** Extract from Vol 14 Figure 13.4.2 (see separate volume of figures)*

Licensed abstractions

13.4.14 The nearest licensed groundwater abstraction from the River Terrace Deposits or upper aquifer is located at 1.1km to the northwest of the Kirtling Street site. The licensed abstraction (28/39/39/0225) is held by the

Royal Horticultural Society and is used for agriculture. A capture zone [xii] was estimated for this source as part of this assessment using licence information and appropriate aquifer properties. The boundaries of this capture zone are at a distance of 1km from the Kirtling Street site. The licensed abstraction is not located hydraulically down gradient of the site. Therefore, this source would not be anticipated to be impacted by construction or operation at the Kirtling Street site (see Vol 14 Figure 13.4.5 in separate volume of figures).

13.4.15 There are six licensed abstractions (28/39/39/0139, 28/39/39/0141, 28/39/42/0074, 28/39/42/0072, TH/39/42/007 and TP07/005) from the lower aquifer located within a kilometre radius of the Kirtling Street site; three of these lying to the east, two to the west, one to the northeast and one to the north. These abstraction sources are used for water supply, industrial, commercial and public services and for GSHP purposes. The locations of certain sources (only the GSHP sources are shown as the publication of the location of other abstractions is not permitted) are shown in Vol 14 Figure13.4.5 (see separate volume of figures).

13.4.16 There are no known unlicensed abstractions from either the upper or lower aquifers locally.

Groundwater source protection zones

13.4.17 The Kirtling Street site is located within the Source Protection Zone 1 (SPZ1) for the Thames Water Utilities source located within a kilometre of the Kirtling Street site in order to safeguard groundwater resources from potentially polluting activities. The SPZ1 is defined as the 50 day travel time from any point below the water table to the source. There is a second SPZ1 delineated for a Chalk abstraction used for water supply purposes to the northeast of the Kirtling Street site.

Environmental designations

13.4.18 There are no designations relevant to groundwater within 1km of the site.

Groundwater quality and land quality

13.4.19 Historical land use mapping at the Kirtling Street site reviewed as part of the land quality assessment has identified various potentially contaminative land uses onsite.

13.4.20 The groundwater quality assessment data obtained from ground investigation boreholes SA1084, SA1082, SR1083, PR1085, PR1088 and PR1081 (located with 1km of the Kirtling Street site and shown in Vol 14 Figure13.4.1 in the separate volume of figures). The data has been compared with the UK drinking water standards[7] or relevant Environmental Quality Standards (EQS) (Defra, 2010)[8]. The data show exceedances with respect to heavy metals, pesticides and hydrocarbon contamination in the River Terrace Deposits and the Chalk. In particular the nearest ground investigation borehole, located at approximately 70m

[xii] Capture zone - the area from which groundwater would be drawn

from the site, shows exceedance for polycyclic aromatic hydrocarbon (PAH) compounds in the Chalk. Further details can be found in Vol 14 Appendix K.7.

13.4.21 The land quality assessment data available for certain on-site monitoring boreholes listed above showed exceedances of the human health screening values (soil guideline values designed to protect human health). Further details are included in the land quality assessment (see Vol 14 Appendix F).

Groundwater flood risk

13.4.22 There are no reported incidents of groundwater flooding in the vicinity of the site, based on information from the London Borough (LB) of Wandsworth Strategic Flood Risk Assessment (SFRA) (Scott Wilson, 2008)[9] (Figure 10 Groundwater flooding records).

Groundwater receptors

13.4.23 Groundwater receptors which could be affected during construction or operation are summarised in Vol 14 Table 13.4.3 below. Both the upper and lower aquifers have been assessed as receptors as both would be penetrated by the main tunnel shaft at the Kirtling Street site. There are six abstraction sources from the Chalk within 1km radius from the site and which have also been assessed for the construction phase.

Vol 14 Table 13.4.3 Groundwater – receptors

Receptor	Construction	Operation	Comment	Licence No.
Groundwater body – upper aquifer	✓	✓	Penetrated by main tunnel shaft	-
Groundwater body – lower aquifer (including the Chalk)	✓	✓	Shaft into Lower Mottled Beds (Lambeth Group) and base slab into Upnor Beds	-
Licensed abstractions - lower aquifer	✓*	✗	Six Chalk abstractions	28/39/39/139 28/39/39/141 28/39/42/074 28/39/42/072 28/39/42/007 TP07/005**
Licensed abstractions – upper aquifer	✗	✗	One River Terrace Deposits abstraction	28/39/39/225
Unlicensed	✗	✗	No known	

Receptor	Construction	Operation	Comment	Licence No.
abstractions			abstractions	
Planned developments and abstractions	✓	✗	Two planned Chalk ground source heat pumps (GSHP) licensed abstractions	

**Abstractions (licensed) would only be affected by construction phase, due to dewatering.*
*** Consent number as no licence number issued yet.*
Symbols ✓ applies ✗ does not apply

Receptor sensitivity

13.4.24 The upper aquifer is classified by the EA as a secondary A aquifer and is allocated a medium value in terms of both quantity and quality in this assessment.

13.4.25 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 (resources). Although the baseline groundwater quality data indicates the presence of certain contaminants, such as PAH, which could compromise the quality, for this assessment the lower aquifer is categorised as being of high value with regard to quality.

13.4.26 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. Larger public water supply abstractions are given a higher value than generally smaller domestic supplies. In this case all of the receptors in the lower aquifer have been identified as high sensitivity receptors. The licensed abstraction from the River Terrace Deposits for industrial, GSHP or agricultural purposes has been allocated a medium value.

13.4.27 A summary of the value and sensitivity of relevant receptors is given in Vol 14 Table 13.4.4.

Vol 14 Table 13.4.4 Groundwater – resources receptors during construction

Receptor	Value/sensitivity
Groundwater quality	
Upper aquifer	Medium value; secondary A aquifer
Lower aquifer	High value; principal aquifer
Groundwater quantity (resources)	
Upper aquifer	Medium value; secondary A aquifer
Lower aquifer	High value; principal aquifer

Receptor	Value/sensitivity
Licensed River Terrace Deposit abstraction 28/39/39/225	Medium value; industrial source, GSHP or agricultural source
Licensed Chalk abstractions 28/39/39/139, 28/39/39/141, 28/39/42/074, 28/39/42/072, TH/39/42/007, TP07/005	High value; drinking water source and large GSHP in Chalk

Construction base case

13.4.28 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 Kirtling Street site, and would have the potential to lead to a change to groundwater for both the upper and lower aquifers.

13.4.29 The basements and SuDS associated with other developments identified in Vol 14 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.

13.4.30 The base case in Site Year 1 of construction at the Kirtling Street site would include the planned abstractions for GSHP in the lower aquifer, at the Riverlight and Effra sites, as identified in Vol 14 Table 13.3.1, as these are likely to be operational at the time of Thames Tideway Tunnel project construction phase.

Operational base case

13.4.31 The operational base case is as per the construction base case.

13.4.32 Therefore it can be concluded that there would be no change to the base case in Year 1 of operation in the case of the upper aquifer. In addition, the dewatering of the lower aquifer would have ceased and therefore there would be no change to the operational base case.

13.5 Construction effects assessment

Construction impacts

Dewatering of aquifers

13.5.1 For the construction of the Thames Tideway Tunnel project as a whole, groundwater levels would have to be lowered by dewatering to allow construction of main tunnel shafts, connection culverts and interception chambers. The impact of this project-wide scale dewatering is discussed in detail in Vol 3 Section 13. Impacts have been quantified by modelling (see Vol 3 Appendix K.2) and the effects, where they are of relevance to the Kirtling Street site, are also included in this assessment.

13.5.2 In order to construct the main tunnel shaft at Kirtling Street, depressurisation of the central part of the Lambeth Group (LG) would be required. The lower part of the Lambeth Group is likely to be in hydraulic connection with the lower aquifer (Upnor Formation, Thanet Sands and Chalk). Depressurisation of the Lambeth Group would be achieved by abstracting water from the Thanet Sands (dewatering) outside the diaphragm wall as described in Section 13.2 (although we have modelled dewatering of the Chalk for the purposes of this assessment).

13.5.3 Details of the groundwater modelling undertaken to inform the assessment of likely significant effects at Kirtling Street are included in Vol 3 Appendix K.2. The current EA and Thames Tideway Tunnel project groundwater level monitoring (see the groundwater monitoring strategy Vol 3 Appendix K.1) reflects the pumping from local abstraction sources, three of which lie to the east, two to the west, one to the northeast and one to the north (see para. 13.4.15). The estimated maximum drawdown at Kirtling Street as a result of dewatering is 28m, assuming a pumped water level of 77mATD and the base of the main tunnel shaft at 49mATD. An estimate of the average amount of dewatering which would be needed at Kirtling Street is around 440m^3/d.

13.5.4 There would be additional drawdown (lowering of groundwater levels) as a result of dewatering at the Kirtling Street shaft described above. The full details of the effects on licensees in the vicinity of Kirtling Street site are set out in the modelling report (see Vol 3 Appendix K.2). For each licensee the impact of drawdown is assessed by comparing it to the maximum available drawdown (MAAD)[xiii] at the licensee's borehole(s) [xiv].

a. In the case of licence number 28/39/39/141 (Mantilla Limited), there are a number of boreholes at Dolphin Square. Modelling has predicted a drawdown of up to 7.6m, which is less than the MAAD of 9m. The magnitude of impact is assessed to be low as the predicted drawdown against the MAAD would be within 20% for approximately two months, outside of this two month period the impact would be negligible.

b. In the case of licence number 28/39/39/139 (Panoramic Management Co Ltd), there are two boreholes. Modelling has predicted a drawdown of 6.4m, which is less than the MAAD of 18m and so impact is assessed to be negligible.

c. In the case of licence number 28/39/42/072 (Thames Water Utilities Ltd) the modelling has a predicted drawdown of 8.6m. The MAAD is 9.7m and so the impact is assessed to be low. The magnitude of impact is assessed to be low as the predicted drawdown against the MAAD would be within 20% for approximately four months, outside of this four month period the impact would be negligible.

[xiii] Maximum available drawdown – is defined as the difference between the pumped water level and depth of the pump or difference between the pumped water level and the top of the Thanet Sand (which is designed to prevent oxidation and the mobilisation of natural pollutants); whichever is least of these two values.

[xiv] Licence number TH/39/42/007 is a GSHP located 100m away from the Kirtling Street site, however information is not available to assess the impact on this source

d. In the case of licence number 28/39/42/074 (Halcyon Estates Limited) the modelling has a predicted drawdown of 7.9m. The MAAD is 44m and so the impact is assessed to be negligible.

e. In the case of licence number 28/39/42/007 (Tarmac Limited) the modelling has a predicted drawdown of 6.3m. The MAAD is 30m and so the impact is assessed to be negligible.

f. Although no details are available for consent number TP07/005 (St George South London Limited) which lies 0.7km to northeast and abstracts from the Chalk for GSHP, it is considered unlikely that it would be affected and the impact magnitude is assessed to be negligible.

Groundwater quality

13.5.5 The baseline groundwater quality data from nearby ground investigation boreholes show exceedances in the River Terrace Deposits and in the Chalk. There are exceedances for heavy metals, pesticides and hydrocarbons in both of these formations.

13.5.6 The quantities of water removed by dewatering at the Kirtling Street site would be disposed of appropriately, following the measures identified within the *CoCP* and subject to EA approval.

13.5.7 A quantitative risk assessment would be undertaken at the Kirtling Street site and approved by the LB of Wandsworth and the EA prior to works commencing.

13.5.8 The main tunnel shaft construction involving a diaphragm wall would contain an effective seal with the surrounding ground, thereby ensuring no pathway for groundwater contamination at the surface or shallow geological units to occur. There is likely to be minimal movement of the contamination identified in the upper aquifer as no dewatering of this aquifer would be required. The magnitude of impact on the upper aquifer is assessed to be negligible.

13.5.9 There is known groundwater contamination within the lower aquifer in this location and dewatering would have the potential to move these contaminants. Substantial dewatering (approximately 2,700m^3/d) would be required for a short period (approximately eight months) while the base slab is being constructed within Upnor Formation (lower aquifer). At other times rate of dewatering would be approximately 400m^3/d from the lower aquifer at the Kirtling Street site. While there are no licensed abstraction sources located between the boreholes in which contamination was identified and the Kirtling Street site, the dewatering has the potential to draw contamination into the SPZ 1 in which the site is situated and towards the major public water supply located at 0.15km to the southwest. However, the period when dewatering is large is only for a period of eight months at the end of Site Year 1 / beginning of Site Year 2 and therefore the potential for movement of contamination in the lower aquifer would be greatest at this time. Although the change in hydraulic gradients and groundwater flow velocities are anticipated to be small (from 177 to 185m/year). The magnitude of impact as a result of mobilising the identified contamination is considered to be low due to the short period of peak dewatering (approximately eight months).

13.5.10 The EA aims to manage groundwater abstractions to keep groundwater levels above the top of the Thanet Sands. The lowering of water levels below the top of the Thanet Sands may lead to deterioration in water quality within the lower aquifer. The 28m of drawdown at Kirtling Street is not anticipated to result in the water level dropping below the top of the Thanet Sands. The magnitude of the impact is therefore assessed to be negligible.

13.5.11 The grouting, if necessary would be in the Lambeth Group. The amount of treatment would depend on the ground conditions encountered during the breakout of the main tunnel shaft. There is the potential for grout contaminated groundwater (characterised by excess turbidity) to migrate and impact on groundwater quality in the lower aquifer (Upnor Formation). Grout setting generally occurs on a timescale of a few minutes and therefore in most circumstances the impact is likely to be localised. The magnitude of the impact on the lower aquifer is assessed to be negligible.

Physical obstruction

13.5.12 The presence of diaphragm walls used to build the main tunnel shaft may disrupt groundwater flows and as a result may alter groundwater levels within both the upper and lower aquifers.

13.5.13 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.2. It is estimated that the groundwater level would rise during the construction phase at the Kirtling Street by approximately 0.4m, based on an estimated hydraulic gradient of 0.004.

13.5.14 Groundwater levels in the upper aquifer can reach 100.6mATD and this is approximately 4m below the existing ground surface at Kirtling Street of 104.4mATD (see Vol 14 Table 13.4.1). There is confining layer overlying the upper aquifer, therefore the small predicted rise in water levels (0.4m) on the south (upstream) side of the Kirtling Street site would represent a rise in piezometric head only. The impact on the upper aquifer from a change in groundwater levels as a result of physical obstruction would be negligible.

13.5.15 The main tunnel shaft base slab would extend down approximately 2.3m (into the Upnor Gravel and Upnor Formation – see Vol 14 Table 13.4.1) into the lower aquifer and may form a physical obstruction to groundwater flows. However the nearest abstraction point in the regional direction of groundwater flow is a sufficient distance from the site for the impact on this source to be negligible.

Construction effects

13.5.16 By combining the impacts identified above with the receptor value as shown in Vol 14 Table 13.4.4, the significance of the effects can be derived using the generic significance matrix (Vol 2 Section 2). The results are described in the following sections.

Dewatering of aquifers

13.5.17 The effects from dewatering of the lower aquifer on licensed abstractions are assessed to be between minor and moderate as follows:

a. Lower aquifer is classified as a high value receptor in terms of groundwater resources. A negligible impact on this high value receptor would result in a **minor adverse** effect.

b. Licence number 28/39/39/141 has been used for drinking water purposes and the source is of high value. A low impact on this high value source would result in a **moderate adverse** effect for approximately two months while the predicted drawdown is within 20% of that available, for the remainder of the construction period there would be a **minor adverse** effect.

c. Licence number 28/39/39/139 is used for industrial and GSHP purposes and is classified as being of high value. A negligible impact on a high value receptor would result in a **minor adverse** effect.

d. Licence number 28/39/42/72 is public water supply source purposes and is classified as being of high value. A low impact on a high value receptor would result in a **moderate adverse** effect for approximately four months while the predicted drawdown is within 20% of that available, for the remainder of the construction period there would be a **minor adverse** effect.

e. Licence number 28/39/42/74 is used for water supply purposes and is classified as being of high value. A negligible impact on a high value receptor would result in a **minor adverse** effect.

f. Licence number 28/39/42/007 is used for GSHP purposes and is classified as being of high value. A negligible impact on a high value receptor would result in a **minor adverse** effect.

g. Consent number TP07/005 is used for GSHP purposes and is classified as being of high value. A negligible impact on a high value receptor would result in a **minor adverse** effect.

Groundwater quality

13.5.18 A negligible impact on the groundwater quality of the lower aquifer as a result of the mobilisation of groundwater and soil contamination in the upper aquifer has been identified. The lower aquifer is a high value receptor and this would result in a **minor adverse** effect.

13.5.19 A temporary low magnitude impact on groundwater quality has been identified for the mobilisation of known contamination in the lower aquifer, a high value receptor; this would result in a **moderate adverse** effect. Mobilisation of the known contamination would be most likely during the intensive eight month dewatering period.

13.5.20 The dewatering at Kirtling Street would not result in groundwater levels being lowered below the top of the Thanet Sands at this location. This negligible impact on the dewatering of the Thanet Sands which are part of the lower aquifer, a high value receptor, would result in a **minor adverse** effect.

13.5.21 A negligible impact on groundwater quality in the lower aquifer has been identified as a result of grouting of the Lambeth Group for the breakout of the TBMs from the main tunnel shaft. A negligible impact on a high value receptor would result in a **minor adverse** effect.

Physical obstruction

13.5.22 The physical impact of all below ground activities upon the local groundwater levels which is likely to result in a 0.4m rise is considered negligible. A negligible impact on a medium value receptor, the upper aquifer with regard to quantity, would result in a **negligible** effect.

13.5.23 The physical impact of the main tunnel shaft upon the lower aquifer as a result of obstruction would have a negligible impact, which on a high value receptor, the lower aquifer with regard to quantity, would result in a **minor adverse** effect.

13.6 Operational effects assessment

Operational impacts

Physical obstruction

13.6.1 The presence of the operational main tunnel shaft may disrupt local groundwater flow and alter groundwater levels.

13.6.2 The methodology for assessing the impact of the main tunnel shaft 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 Kirtling Street would be less than 0.1m.

13.6.3 There is a confining layer overlying the upper aquifer, therefore the small predicted rise in water levels (<0.1m) on the southern (upstream) side of the Kirtling Street site would represent a rise in piezometric head only. The resulting impact on the upper aquifer would be negligible.

13.6.4 The main tunnel shaft would extend down into the top of the lower aquifer by approximately 2.3m (into the Upnor Formation only). This short distance means that the physical impact of the main tunnel shaft upon the lower aquifer can be considered negligible.

Seepage from main tunnel shaft

13.6.5 An estimate of the theoretical seepage volumes from the main tunnel shaft at Kirtling Street 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 main tunnel shaft into the upper aquifer is $3m^3$/annum (Vol 2 Appendix K, Vol 2 Table K.5). The higher heads outside the drop shaft mean that any risk of seepage from the drop shaft into the upper aquifer would be further reduced. The magnitude of impact has been assessed as negligible for the upper aquifer.

13.6.6 The estimated volume of seepage from the main tunnel shaft into the lower aquifer is $2m^3$/annum (Vol 2 Appendix K, Vol 2 Table K.5). The magnitude of impact has been assessed as negligible for the lower aquifer.

Seepage into main tunnel shaft

13.6.7 An estimate of the seepage volumes into the main tunnel shaft at Kirtling Street is included in Vol 2 Appendix K.3. The estimated loss of water from the upper aquifer into the shaft would be 114m^3/annum (Vol 2 Appendix K, Vol 2 Table K.4). This level of seepage into the main tunnel shaft would be negligible for the upper aquifer.

13.6.8 The estimated loss of water resources from the lower aquifer is 83m^3/annum which is considered to be a negligible impact.

13.6.9 No other operational impacts are envisaged.

Operational effects

13.6.10 Combining the receptor value (see Vol 14 Table 13.4.4) with the impacts identified above, the significance of the effects can be derived using the generic significance matrix (Vol. 2 Section 2). The results are described in the following sections.

Physical obstruction

13.6.11 The upper aquifer is a secondary A aquifer and is of medium value with regards to quantity (resource) (see Vol 14 Table 13.4.4). The upper aquifer is confined and as such the impacts would be negligible. A negligible impact on a medium value receptor would result in a **negligible** effect.

13.6.12 The negligible impact of physical obstruction on the high value lower aquifer would result in a **minor adverse** effect.

Seepage from main tunnel shaft

13.6.13 Seepage from the main tunnel shaft has been determined as a negligible impact on groundwater quality in case of both the upper and lower aquifers. A negligible impact on a medium value receptor, the upper aquifer, would lead to a **negligible** effect. A negligible impact on a high value receptor, the lower aquifer, gives an overall **minor adverse** effect.

Seepage into main tunnel shaft

13.6.14 Seepage into the main tunnel shaft has been determined as a negligible impact, which on a medium value aquifer (the upper aquifer) would lead to a **negligible** effect. The same impact on a high value receptor (the lower aquifer with regards to quantity) would lead to a **minor adverse** effect.

13.7 Cumulative effects assessment

Construction effects

13.7.1 Nine developments identified in Vol 14 Table 13.3.1 which could give rise to cumulative effects to groundwater in the upper aquifer through the inclusion of basements and SuDS schemes. It is considered that although there may be local impacts on groundwater levels in the upper aquifer due to the vicinity of the developments, these impacts are not expected to be significant. This is because a majority of the developments are located a long distance away from the main tunnel site and are down the hydraulic gradient, within the upper aquifer. The upper aquifer is also confined at this site by an overlying layer of Alluvium and Made Ground, which means that any build up in water would manifest as an increased pressure rather than a physical rise in water levels. Any substantive changes to the baseline conditions prior to construction would be detected by monitoring.

13.7.2 One development identified in Vol 14 Table 13.3.1 which could give rise to cumulative effects to groundwater resource in the lower aquifer through the inclusion of a GSHP, although this is non-consumptive system and likely to be of negligible impact. The GSHP has already been considered in the construction base case assessment as the development would already be partially complete and operational. Therefore, no additional effects on groundwater during construction would remain as described in Section 13.5.

Operational effects

13.7.3 Three developments are identified in Vol 14 Table 13.3.2 as being under construction during the operational phase which could give rise to cumulative effects in the upper aquifer. It is considered that any impacts would not be significant. This is because, as for construction, these developments are located a long distance from the main tunnel site and are down the hydraulic gradient, within the upper aquifer. The upper aquifer is also confined at this site by an overlying layer of Alluvium and Made Ground, which means that any build up in water would manifest as an increased pressure rather than a physical rise in water levels. Any substantive changes to the baseline conditions prior to operation would be detected by ongoing monitoring.

13.7.4 None of the developments would impact on the lower aquifer and therefore there would be no cumulative groundwater effects on the lower aquifer.

13.8 Mitigation

13.8.1 This section sets out further mitigation measures to be taken to address the significant effects identified within the assessment.

13.8.2 Moderate adverse effects are identified for the construction phase only and are as follows:

a. deterioration of groundwater quality in the SPZ1 of the lower aquifer as a result of potential movement of known groundwater contamination (this would be most likely for a period of eight months)

b. effects on two licensed abstractors (Licence number 28/39/39/141 and 28/39/42/72) for two and four months respectively.

Mitigation of construction effects

13.8.3 Appropriate mitigation to overcome the potential deterioration of groundwater quality within the lower aquifer as a result of the potential movement of contamination could comprise of limiting the amount of dewatering of the lower aquifer, in particular from the Chalk. Pumping tests at the site would confirm the volumes of dewatering required and also the potential, for both the construction of the base slab and the launch of the TBMs to be dewatered locally within the Upnor Formation and Lambeth Group respectively. If it were possible to dewater within these strata it would reduce the overall impacts of dewatering and reduce the risk of migration within the lower aquifer and towards the SPZ 1. Internal dewatering and increased ground treatment , possibly including ground freezing, could be used to further limit the amount of dewatering required.

13.8.4 Moderate adverse effects on the licensed abstractions (28/39/39/141 – Mantilla Limited and 28/39/42/72 – Thames Water Utilities Ltd, both of which are high value receptors) have been identified. The mitigation for these sources could comprise lowering pumps, deepening boreholes or, in the case of 28/39/39/141 provision of an alternative supply. These options will be discussed with the licence holder and mitigation measures agreed. In the case of 28/39/42/72, this source is one of several sources operated by Thames Water and the flexibility within its supply network may mean that another source could be used for a short period, rather than provision of new supply.

13.8.5 The groundwater monitoring strategy (see *CoCP* as mentioned in para. 13.2.4) is part of the overall project-wide mitigation. A comprehensive network of monitoring boreholes has been installed in both the upper and lower aquifers. The ongoing monitoring of groundwater levels and groundwater quality will detect any substantive changes from the baseline conditions during both the construction and operational phases.

13.9 Residual effects assessment

Construction effects

13.9.1 The measures proposed to mitigate the potential movement of known groundwater contamination within the lower aquifer would have the effect of reducing this residual construction effect to a minor adverse effect.

13.9.2 The measures proposed to mitigate the potential impacts to licensed abstractions would have the effect of reducing these residual construction effects to minor adverse effects.

13.9.3 All residual effects are presented Section 13.10.

Operational effects

13.9.4 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 14 Table 13.10.1 Groundwater – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Lower aquifer (licensed Chalk abstractions)	Lowering of groundwater levels in the Chalk resulting from dewatering	Lower aquifer – Minor adverse 28/39/39/141 – Moderate adverse 28/39/39/139 – Minor adverse 28/39/42/72 – Moderate adverse 28/39/42/74 – Minor adverse 28/39/42/007 – Minor adverse TP07/005 – Minor adverse	For moderate adverse effects - lowering of pump with modified pumping regime, provision of alternative supply (in the case of 28/39/39/141) or use of alternative public water supply source (in the case of 28/39/42/72) The use of internal dewatering and increased ground treatment, such as ground freezing.	Minor adverse
Upper aquifer (licensed River Terrace Deposits abstractions)	Lowering of groundwater levels in the River Terrace Deposits resulting from dewatering	28/39/39/225 - Negligible	None	Negligible
Lower aquifer (groundwater quality)	Deterioration in groundwater quality caused by creation of a pathway between upper and lower aquifer	Minor adverse	None	Minor adverse
	Deterioration in groundwater quality	Moderate adverse	Internal dewatering and increased ground treatment,	Minor adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
	caused by creation of a pathway		such as ground freezing.	
	Deterioration in groundwater quality from groundwater mixing	Minor adverse	None	Minor adverse
	Deterioration in water quality in the lower aquifer from grouting	Minor adverse	None	Minor adverse
Upper aquifer	Change in groundwater heads as a result of physical obstruction in upper aquifer	Negligible	None	Negligible
Lower aquifer	Change in groundwater heads as a result of physical obstruction in lower aquifer	Minor adverse	None	Minor adverse

Vol 14 Table 13.10.2 Groundwater – operational assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Upper aquifer	Change in groundwater heads as a result of physical obstruction	Negligible	None	Negligible
Lower aquifer	Change in groundwater heads 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 main tunnel drop shaft	Negligible	None	Negligible
Lower aquifer	Deterioration in water quality in the lower aquifer from seepage out of main tunnel drop shaft	Minor adverse	None	Minor adverse
Upper aquifer	Seepage into shaft affecting groundwater resources	Negligible	None	Negligible
Lower aquifer	Seepage into shaft affecting groundwater resources	Minor adverse	None	Minor adverse

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 level contours for the Chalk aquifer* (2011b).

[5] British Geological Survey. British geology onshore digital maps 1:50 000 scale. Received from Thames Tunnel, February 2009.

[6] Environmental Agency, (2011b). See citation above.

[7] *The Water Supply (Water Quality) Regulations*,(2000). Available at: http://www.legislation.gov.uk/uksi/2000/3184/contents/made

[8] 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/

[9] Scott Wilson Ltd. *London Boroughs of Wandsworth, Merton, Sutton and Croydon. Level 1 Final Report (*2008).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.14**

Volume 14: Kirtling Street site assessment

Section 14: Water resources - surface water

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling 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 Kirtling 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 Volume 2 Environmental assessment methodology 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 construction activities. Operational effects on surface water at this site have not been assessed. This is on the basis that there would be no combined sewer overflow (CSO) interception at the Kirtling Street site and no significant operational surface water effects are considered likely. For this reason only information relating to construction is presented in the assessment of effects on surface water.

14.1.3 The assessment of construction 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 from the proposed development during construction

d. identification of mitigation measures and the residual effects during construction.

14.1.4 The assessment of surface water effects 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. 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 Kirtling Street site. The catchment-wide effects on the tidal Thames, particularly in relation to the water quality improvements anticipated from the Thames Tideway Tunnel project are assessed separately and presented in Volume 3 Project-wide effects assessment.

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 14 Kirtling Street Figures).

14.2 Proposed development relevant to surface water

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 Kirtling Street site is located immediately behind the flood defences on the south bank of the River Thames, although the proposed construction of a conveyor jetty for the export of excavated material means that some of the working area would be located within the river channel.

14.2.3 Barges would be used to export the majority of the excavated material from the main tunnel and would also be used to import the majority of the aggregates for the tunnel secondary lining, although it is assumed that other imported materials would be brought in by road. Shaft excavations would be removed by road as the shaft excavation would be carried out while the jetty was being constructed. The river channel would be dredged to provide sufficient depth of water at all tides to allow the barges to moor up adjacent to the site while loading and unloading occurs.

14.2.4 A main tunnel shaft would be constructed at the site. Based on the geology at the site, the construction of the base of the shaft and associated infrastructure would require dewatering and/or ground treatment. Disposal of dewatering effluent could have an impact on surface water. See Section 13 of this volume for further details on the dewatering requirements.

14.2.5 The construction of the jetty within the river would affect the river regime with the potential that localised increases in flow velocity cause scour of the river bed and foreshore, or deposition of sediments. The scour could occur around the face of the cofferdam (abutment scour) or across the channel width (contraction scour). Any potential scour development during construction would be monitored and if relevant trigger levels are reached, appropriate protection measures would be provided. Further details are provided in the *Scour and Accretion Monitoring and Mitigation Plan for Temporary Works in the Foreshore* (Vol 3 Appendix L.4).

Code of Construction Practice

14.2.6 There is a direct pathway for pollutants to be discharged to the tidal Thames due to the location of part of the construction area within the river channel. 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.

14.2.7 Appropriate drainage, sediment and pollution control measures are included in the *CoCP* Part A (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.

14.2.8 All site drainage would be drained and discharged to mains foul or combined sewers. Where this is not practicable, the site would be drained such that accumulating surface water would be directed to holding or settling tanks, separators and other measures prior to discharge to the surface water drains. Foul drainage from the site welfare facilities would be connected to the mains foul or combined sewer.

14.2.9 Suitable spill kits would be provided and positioned in vulnerable areas, 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 any 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*).

14.2.10 The *CoCP* Part B (Section 8) contains one site specific measure, that appropriate measures to avoid water runoff to the river need to be adopted specifically in consideration of local unremediated former gas works. There are no other site-specific measures incorporated in the *CoCP* Part B (Section 8) relevant to the surface water assessment.

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 Vol 2 Section 14. A WFD assessment for the project as a whole is presented in Vol 3 Section 14.

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

Engagement

14.3.2 Vol 2 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Vol 2 Section 14 summarises the engagement that has been undertaken for the surface water assessment and the consultation responses relevant to surface water.

14.3.3 There are no site specific engagement comments relevant to the surface water assessment at the Kirtling Street site.

14.3.4 The *Scoping Report* was prepared before Kirtling Street had been identified as a preferred site. The scope for the assessment of surface water for this site has therefore drawn on the scoping response from the London Borough (LB) of Wandsworth in relation to other sites and is based on professional judgement as well as experience of similar sites.

Baseline

14.3.5 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

14.3.6 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.

14.3.7 The assessment year for construction effects is Site Year 1 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.

14.3.8 The Lee Tunnel and the sewage works upgrades at Mogden, Beckton, Crossness, Long Reach and Riverside sewage treatment works (STWs) would be operational by the time construction of the Thames Tideway Tunnel project commences, as described in Vol 2 Section 14. Significant improvements in the water quality in the tidal Thames are anticipated as a result of these projects. The base case would therefore be the water quality in the tidal Thames with the Lee Tunnel and sewage works upgrades in place.

14.3.9 The construction base case has considered the developments that are scheduled to be complete and in operation by Site Year 1 (presented in Vol 14 Appendix N). The developments in Vol 14 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. It is considered unlikely that the Nine Elms Pier development, which would result in the construction of a new marina adjacent to the site, would affect water quality as the development would replace the existing pier. The base case would therefore not change from that outlined above.

14.3.10 The developments that have been identified in Vol 14 Appendix N that would be under construction during Site Year 1, have been considered in the a cumulative effects assessment (Section 14.7).

14.3.11 The assessment area for the assessment of effects of construction activities at Kirtling Street site would be limited to two sections of the river, namely the Thames Upper and Middle waterbodies listed below in Vol 14 Table 14.4.1.

14.3.12 Section 14.5 details the likely significant effects arising from the construction at the Kirtling Street site. The Heathwall Pumping Station site is located east of the Kirtling Street site. It is considered unlikely that the construction of the Heathwall Pumping Station site would give rise to additional effects on surface water within the assessment area for this site therefore the Heathwall Pumping Station site is not considered in this assessment. The assessment of effects on surface water from the construction and operation at the nearby Heathwall Pumping Station site is contained in Vol 15 Section 14.

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 construction of the base of the shaft and associated infrastructure would require dewatering and/or ground treatment. There are no other assumptions and limitations specific to the assessment of this site.

14.4 Baseline conditions

14.4.1 The following section sets out the baseline conditions for surface water within and around the site. Future baseline conditions (base case) are also described.

Current baseline

Water quality

14.4.2 A list of all surface water receptors and their WFD status given in the *River Basin Management Plan* (*RBMP*) (EA, 2009)[4], which are either adjacent to the site or downstream of the site and therefore have the potential to be affected by the proposed development, is included in Vol 14 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 14 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 Upper GB530603911403	Heavily modified	Moderate potential	Good	Moderate potential	Good	Good
Thames Middle GB530603911402	Heavily modified	Moderate potential	Fail	Moderate potential	Fail	Good

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 Upper (which stretches from Teddington to Battersea Bridge) and the Thames Middle (which stretches from Battersea Bridge to Mucking Flats) waterbodies are considered to be high value waterbodies, as although the current and predicted status in 2015 (target date from *RBMP* [EA, 2009][7]) is moderate potential, a status objective of good by 2027 has been set for both. In addition, the tidal Thames is a valuable water resource, habitat and source of amenity, recreation and transport route throughout London.

14.4.5 Sediment levels within the tidal Thames are estimated to currently reach a peak of 4,000kg/s in the lower tidal Thames estuary, or more than 40,000t (or 20,000m^3 assuming an in-situ density of 2t per m^3) of sediment a day during spring tides (HR Wallingford, 2006)[8].

14.4.6 There are no licensed surface water abstractions within 1km of the Kirtling Street site. The Kirtling Street site is approximately 2km downstream of the Cadogan Automatic Quality Monitoring Station (AQMS) monitoring point, as shown in Vol 14 Figure 14.4.1 (see separate volume of figures). 2011 summary data from this monitoring point, which gives monthly 90 percentile values for ammonium (concentration that is exceeded 10% of the time) and 10 percentile values for dissolved oxygen (concentration that is exceeded 90% of the time) are presented below in Vol 14 Table 14.4.2.

Vol 14 Table 14.4.2 Surface water – Cadogan Pier AQMS

Month	DO (mg/l) (10%)	Ammonium (mg/l) (90%)
January	11.06	4.15
February	9.18	0.57
March	8.44	0.84
April	5.89	1.54
May	6.15	1.84
June	3.70	1.68
July	3.17	1.90

Month	DO (mg/l) (10%)	Ammonium (mg/l) (90%)
August	3.04	3.06
September	4.34	4.04
October	5.60	6.24
November	5.22	4.80
December	8.09	4.41

14.4.7 The data presented above demonstrate that the dissolved oxygen (DO) levels in the tidal Thames decrease in the summer months, as there is an inverse relationship between temperature and oxygen saturation ie, warmer water holds less DO than colder water. The discharge from CSOs has the effect of depleting DO in the tidal Thames as a result of the biological breakdown of organic matter in the discharges. Vol 3 Section 14 details half-tide plots displaying the changes in DO levels along the tidal Thames.

14.4.8 The Kirtling Street site is within an area of past potentially contaminative industrial uses. Potential off-site contamination sources include historic and existing industries including a concrete depot, power station, and gas works. Typical contaminants associated with these industries include hydrocarbons, phenols, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyl (PCB) and heavy metals. An assessment of potential on-site contamination is provided within Section 8 of this volume.

Construction base case

14.4.9 As explained in Section 14.3, the base case would be the water quality in the tidal Thames with the Lee Tunnel and sewage works upgrades in place.

14.4.10 The base case in Site Year 1 of construction taking into account the scheme described in Section 14.3 would not change since no new sensitive receptors would be introduced.

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 and pollution during jetty construction and operation

14.5.2 As the main tunnel shaft is to be constructed behind the river wall the main pathway for impact and effect on surface water resources and associated receptors during construction at Kirtling Street would be from the construction and operation of the jetty. The jetty would be established by driving tubular piles from a jack up barge into the river bed. Once these are in place, a temporary steel/timber deck would be erected and a permanent reinforced concrete slab deck would be cast in-situ. As some of the construction works would take place in the foreshore, there is a direct pathway for contaminated run-off, high suspended solids and other pollution from the site during construction of the jetty, which could impact on water quality in this location of the tidal Thames.

14.5.3 Once constructed, the jetty would support a conveyor, which would deposit excavated material directly into barges. There is the potential for pollution of the tidal Thames if materials are dropped or spilled during the loading and unloading of barges. However, the conveyor would be enclosed and would contain any material that may fall from the conveyor. This would remove the impact pathway from this effect, which is not considered further within this assessment.

14.5.4 There is also an indirect pathway for contamination from the construction work which would take place behind the flood defences, via the surface water drainage system. 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)).

Release of sediments from piling, dredging and scour

14.5.5 At the Kirtling Street site some dredging may be required to allow barges to moor to the temporary works. Dredging would be carried out during restricted periods to avoid sensitive periods for fish spawning (as outlined in the *CoCP* Part A (Section 8)). In addition, monitoring of the river morphology at this point would be carried out, to ensure no emergency dredging would be required, particularly during the sensitive periods. The proposed dredge volume at this site is estimated as 2,500m^3 at the main construction site. It has also been estimated that there would be a loss of 5% of the dredged material to the water column, and therefore an estimated 125m^3 (or 250t assuming an in-situ density of 2t per m^3) of sediment being released during the dredging operation.

14.5.6 The act of piling to construct the jetty could disturb bed sediments in the immediate vicinity allowing fine sediments to be mobilised into the water. The total volume of sediment released to the tidal Thames by the proposed pilling activity at all construction sites has been estimated to be 890t[ii]. The proportion of this estimate that would originate from the Kirtling Street site is approximately 33t.

14.5.7 It is also possible that the jetty would affect the river regime with the potential that localised increases in flow velocity cause scour of the river bed and foreshore and could result in the mobilisation of suspended solids (see Section 14.5). Any potential scour development during construction

[ii] An assessment of the potential sediment losses anticipated from construction activities within the foreshore is provided in the *Habitats regulation assessment.*

would be monitored and protection measures provided if set trigger levels are reached.

14.5.8 The tidal Thames is a high sediment environment. Levels already present within the tidal Thames are estimated to be a peak of 4,000kg/s in the lower Thames estuary which equates to more than 40,000t (or 20,000m^3) of sediment passing the site four times a day during spring tides. In this context, the volumes produced by the construction works from piling or scour would not be detectable against natural fluctuations in sediments and would not have an impact on surface water resources (HR Wallingford, 2006)[9] and are therefore not considered further within the assessment.

Foreshore and contamination within the river channel

14.5.9 The Kirtling Street site is within an area of past potentially contaminative industrial uses. Given the current environment (ie, significant water flow and sediment movement), it is expected that the majority of mobile contaminants have already been leached from the sediment, although any further disturbance of sediments caused by the proposed construction works could cause additional sediment contamination to be leached.

14.5.10 Any additional sediment input to the river as a result of construction processes would be minimal in comparison to the already high background levels (see para. 14.4.5) and any mobilised contaminants would be expected to be rapidly diluted and their potential impact on water quality attenuated. Sediments mobilised by the construction works (including piling for the jetty) are therefore likely to pose only a low risk of causing deterioration in water quality. Such sediments are continually transported along the tidal Thames as part of natural erosion and deposition, as well as by other dredging operations and river users.

14.5.11 Therefore, there is considered to be no impact from this source and this is not considered further within this assessment.

Surface water drainage

14.5.12 The construction of the working area and drainage of surface water from it could create a direct 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 not considered further within this assessment.

Dewatering

14.5.13 Based on the geology at the site, the base of the main tunnel shaft would require dewatering and/or ground treatment. See Section 13 of this volume for further details on the dewatering requirements. Depending on the quality of the groundwater that is pumped out, there could be an impact on water quality of the tidal Thames.

14.5.14 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

14.5.15 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 As explained in para. 14.1.2, the operational phase has not been assessed for surface water as there is no CSO interception at the Kirtling Street site and no likely significant effects are anticipated from the proposed development during operation.

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 the sewage treatment 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 projects described in Vol 14 Appendix N, which could potentially give rise to cumulative effects with the proposed development at Kirtling 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 phases at this site 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 No significant cumulative effects have therefore been identified for the construction phase at this site and therefore the effects on surface water would remain as described in Section 14.5 above.

14.8 Mitigation

14.8.1 No significant adverse effects have been identified and no mitigation is required.

14.9 Residual effects assessment

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.

14.10 Assessment summary

Vol 14 Table 14.10.1 Surface water – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Thames Middle and Upper	The assessment has not identified any likely significant effects.	N/A	N/A	N/A

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[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.

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[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/.

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[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] HR Wallingford. See citation above.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

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Volume 14: Kirtling Street site assessment

Section 15: Water resources - flood risk

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 14: Kirtling Street site assessment

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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 Kirtling Street site. This FRA has been developed in line with the requirements of the National Policy Statement (NPS) for Waste Water (Defra, 2012)[1] Section 4.4 and includes a qualitative appraisal of the flood risk posed to the site, the potential impact of the development on flood risk on and off the site and an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. Further details on how the NPS requirements relevant to flood risk have been met can be found in Vol 2 Environmental assessment methodology Section 15.3.

15.1.2 The proposed development is described in Section 3 of this volume. Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 14 Kirtling Street Figures).

15.1.3 A summary of the regulations and policy that have informed the assessment are presented in this section. Section 15.2 provides a summary of the elements of the proposed development relevant to flood risk. Section 15.3 provides an assessment of the flood risk to the site and elsewhere as a result of the development, during both the construction and operational phases. Section 15.4 provides details of the design measures that have been adopted within the proposals to ensure the flood risk to the site is not increased and ensure that flood risk does not increase elsewhere.

15.1.4 The assessment of flood risk should be considered in conjunction with the assessment of other water resources ie, groundwater and surface water. The assessment of effects on groundwater is presented in Section 13 Water resources – groundwater. The assessment of effects on surface water is presented in Section 14 Water resources – surface water.

15.1.5 A project-wide FRA has been undertaken and is presented in Volume 3 Project-wide assessment.

Regulatory context

15.1.6 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.

15.1.7 A review of planning policy relevant to the proposed development is provided in Vol 14 Appendix M.1.

NPS Sequential and Exception Tests

15.1.8 The Waste Water 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.

15.1.9 The NPS states that the Exception Test should be applied where it is not possible for the project to be located in zones of lower probability of flooding than Flood Zone 3.

15.1.10 The Exception Test is detailed in Section 4.4.15 of the NPS. The test requires overall sustainability benefits (Part A) to outweigh flood risk, whilst ensuring the development is safe and does not increase flood risk elsewhere (Part C) and is preferably located on previously developed land (Part B).

15.1.11 The overall project is considered to pass the Sequential Test, as detailed in Vol 3 Section 15. The project wide Exception Test is also detailed in Vol 3 Section 15.

15.1.12 The proposed development at Kirtling 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.

15.1.13 The proposed development at Kirtling Street would be located on previously developed land, therefore satisfying part b) of the Exception Test.

15.1.14 This FRA shows that the proposed development would be appropriate for the area as flood risk to the development would be managed through appropriate design measures and the development would not lead to an increase in flood risk on the surrounding areas. Therefore, part c) of the Exception Test has also been met.

15.2 Elements of the proposed development relevant to flood risk

15.2.1 The proposed development at this site is described in Section 3 of this volume.

15.2.2 The elements of the proposed development relevant to flood risk are set out below.

Construction

15.2.3 The construction elements of the proposed development relevant to flood risk include:

a. A drive shaft would be constructed to drive the main tunnel to the east to Chambers Wharf and to the west to Carnwath Road Riverside.

b. A 130m piled jetty would be constructed to allow barges to moor and be loaded or unloaded. Two conveyors would move material from the site to the jetty and onto barges.

c. Reconfiguration of the site layout would occur to allow tunnelling works following completion of the shaft construction.

d. The capacity of the local sewer network would not be altered during construction.

Code of construction practice

15.2.4 Appropriate guidance regarding flood defence construction and emergency planning are included in the *Code of Construction Practice (*CoCP*)*. The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

15.2.5 The *CoCP* (Section 8) states that no temporary living accommodation would be permitted onsite and that safe refuge should be provided in the event of a flood event.

15.2.6 The *CoCP* (Section 8) states that the contractor would be responsible for providing and maintaining continuous flood defence provision, for both permanent and temporary works, to the statutory flood defence level[i] as detailed within the FRA. This is a requirement of the Thames River Protection of Floods Amendment Act 1879[2].

Operation

15.2.7 The permanent elements of the proposed development relevant to flood risk include:

a. The north-western section of the site would contain the permanent works. This area would be re-instated as a safeguarded wharf.

b. The shaft at Kirtling Street would not intercept any CSO flows and would only be used for tunnel access. Surface water runoff from the permanent development inland would be discharged into the existing concrete batching works drainage system.

15.3 Assessment of flood risk

Introduction

15.3.1 The Waste Water NPS requires that all potential sources of flooding that could affect the proposed development are considered.

15.3.2 This assessment is based on a FRA screening exercise that identified relevant potential flood sources and pathways. The tidal and fluvial

[i] The level to which the flood defences must be maintained to ensure that both the sites themselves and third-party land and assets in the surrounding area are protected from flooding.

assessments were based on the flood zones which do not take account of 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)* (DCLG, 2012)[3] 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).

Tidal flood risk to the proposed development

Level of risk based on the flood zones

15.3.5 The Kirtling Street site is situated on the frontage of the tidal Thames. The location of the site in relation to the flood zones is shown in Vol 14 Figure 15.3.1 (see separate volume of figures). The operational part of the site is located behind the tidal Thames flood defences within Flood Zone 3a and therefore the risk of tidal flooding to the operational (permanent) part of the site is considered to be high (see methodology in Vol.2).

15.3.6 The river jetty and overhead conveyors would be constructed within the foreshore of the tidal Thames. As this component of the site is located within the foreshore of the tidal Thames, it is part of the active floodplain of the tidal Thames and subject to frequent tidal inundation. The site is therefore considered as functional floodplain and is classified as Flood Zone 3b (land where water has to flow or be stored in times of flood). Due to the undefended nature of the floodplain at this location and the frequency at which tidal inundation occurs, the "risk of flooding" to this component of the site is considered to be very high. The jetty is however a water compatible structure and as such, no specific design measures have been identified in relation to flood risk.

Existing tidal defences

15.3.7 A raised flood defence wall follows the boundary of the tidal Thames and separates the inland part of the site and the adjacent tidal foreshore.

15.3.8 The Environment Agency (EA) has stated that the statutory flood defence level relevant to the Kirtling Street site is 5.41m Above Ordinance Datum (AOD). The National Flood and Coastal Defence Database (NFCDD) (EA, 2011)[4] crest levels for the flood defences interfacing with the proposed works at the site are 5.82mAOD to the west and 5.88mAOD to the east. Further west crest levels reduce to 5.69mAOD.

15.3.9 Condition surveys of the flood defences carried out by the EA in March 2011 (EA, 2012)[5] state that the flood defences at this location are in good condition (Grade 2), with some areas in fair condition (Grade 3).

15.3.10 The operational part of the site is defended from tidal flooding to the statutory level, but flood waters could inundate the site in the event of overtopping (for example if the Thames Barrier fails to close during an extreme tidal event) or a failure of the flood defences as a result of a breach.

15.3.11 The *Strategic Flood Risk Assessment (SFRA)* for the London Borough (LB) of Wandsworth (Scott Wilson Ltd, 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 results of the SFRA show that in the event of a breach in the flood defences (located approximately 300m to the east of the site) the southern section of the site would be a subject to a flood hazard (Defra and EA, 2006)[7] ranging from low to medium[ii]. The breach modelling shows that the northern section of the site would not be affected by floodwaters during the modelled event. 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

15.3.12 The most extreme flood risk scenario that could affect the site would be a combination of a high tide with a storm surge in the Thames Estuary. This scenario, assuming the Thames Barrier is operational, is the EA's 'design flood' event, a hypothetical flood representing a specific likelihood of occurrence, in this case the 1 in 200 year (0.5% Annual Exceedance Probability[AEP][iii]) flood event.

15.3.13 The *Thames Tidal Defences Joint Probability Extreme Water Level Study* (EA, 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 tidal Thames.

15.3.14 Vol 14 Table 15.3.1presents the modelled tidal levels from this study for model node 2.30 which is the most relevant (ie, closest) to the site (see Vol 14 Figure 15.3.1). 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.

15.3.15 Vol 14 Table 15.3.1 also identifies that the existing defence levels at the site are above the 0.5% AEP tidal flood level, therefore the inland component of the site is protected from tidal flooding to the statutory level.

Vol 14 Table 15.3.1 Flood risk – modelled water levels

Return period	Flood level (mAOD)	Statutory flood defence level (mAOD)
0.5% AEP (2005)	5.01	5.41

[ii] Designated using a combination of consequence and distance from the defence as per the Defra publication 'Flood Risks to People'[ii]

[iii] A flood with a 0.5% Annual Exceedance Probability (AEP) has a one in 200 year probability of occurring in a given year.

Return period	Flood level (mAOD)	Statutory flood defence level (mAOD)
0.5% AEP (2107)	4.99	

Tidal risk from the proposed development

15.3.16 Following construction of the proposed development there are no proposed changes to the flood defences adjacent to the site. The risk of tidal flooding would remain a residual risk as the site is located in Flood Zone 3a. Therefore the flood risk from this source would be unchanged.

Flood defence integrity

15.3.17 The tunnel excavation process, using tunnel boring machines (TBMs) and other construction methods, has the potential to create differential settlement (that is a gradual downward movement of foundations due to compression of soil), which could affect the level of some of the existing flood defences (as well as other buildings and structures). The proposed main tunnel route passes under the existing defences at two points in the immediate vicinity of the Kirtling Street site.

15.3.18 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.

15.3.19 A potential settlement of between 17mm and 43mm is estimated to occur across the river walls at the site (based on information provided by Thames Water). The flood defence levels following settlement is estimated to range from 5.65mAOD to 5.86mAOD. The flood defences would therefore not fall below the EAs statutory flood defence level (5.41mAOD) as a result of this degree of settlement.

15.3.20 An initial assessment of the effect of construction activities on the structural integrity of flood defences at this site was undertaken by Thames Water. This considered effects from ground movement as well as a range of other construction-related impacts where applicable. The assessment indicated potential structural impacts on the flood defences at the site arising from additional surcharge loading and pressure on wall during diaphragm wall construction.

15.3.21 The proposed schedule of works (Schedule 1 of *The Draft Thames Water Utilities Limited (Thames Tideway Tunnel) Development Consent Order*) includes a provision for "works for the benefit of the protection of land or structures affected by the authorised project" which would provide the powers to mitigate for any impact on the flood defences at the site.

15.3.22 Temporary works on the site include the construction of an excavated material jetty with two fixed conveyors. The overhead conveyors would move material to the jetty over the existing flood defences. This could affect flood defences by applying additional loadings to the river walls. Therefore, it would be ensured that the structural integrity of the defences is protected to allow for any additional potential loadings (applied or accidental) whilst maintaining the same standard of protection.

Flood defence line

15.3.23 The proposed works are located on either side of the flood defences and would not influence the existing flood defence line as an overhead conveyor would be used to transport materials between barges and the main site.

Scour management

15.3.24 The *Thames Estuary 2100 Plan* (TE2100) (EA, 2012)[9] includes an assessment of the tidal Thames foreshore at this location where there are long lengths of naturally eroding reaches of the tidal Thames. Results from the above study show that works within the foreshore at this site may have an influence on downstream river structures if the pattern of sediment movement is greatly changed. In addition, should any temporary works within the river cause the channel width to be considerably altered, the flow velocity of the river at this point may vary, thereby altering contraction scour across the channel bed.

15.3.25 A scour summary report summarises the modelling studies that have been undertaken to determine the magnitude of scour associated with both the temporary and permanent works at ten foreshore sites on the tidal Thames (Vol.3, Appendix L.3) including the Kirtling Street site.

15.3.26 Scour is predicted at the Kirtling Street site to be greatest during construction with maximum estimated scour depths to temporary works of up to 0.5m. The contraction scour has been estimated during construction to be less than 0.1m across the river bed and less than 0.1m at the adjacent river walls.

15.3.27 The temporary works have therefore the potential to influence scour and or deposition rates within the river and affect river structures including flood defences.

Loss of volume from the tideway

15.3.28 The presence of temporary structures within the foreshore has the potential to reduce the availability of flood storage within the tidal 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.

15.3.29 The Kirtling Street Site is located within the reach of Chelsea to Westminster in the tidal and fluvial modelling study. The modelling identifies that for this reach the potential maximum decrease in peak water level is 0.029m during the temporary works scenario reducing to 0.014m during the permanent scenario. The modelling also identifies a potential maximum increase of 0.013m in peak water level during the temporary works scenario reducing to 0.004m during the permanent scenario.

15.3.30 As identified in para.15.3.8 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 between 0.7-0.89m 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.

15.3.31 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

15.3.32 At this location along the tidal Thames, both fluvial and tidal inputs are component parts of the resulting water level. The results of flooding from the tidal influence of the tidal Thames are judged to be of greater importance than those from fluvial influences (see methodology in Vol.2). As the permanent works at the Kirtling Street site would be located within Flood Zone 3a, and as the tidal and fluvial floodplain cannot be distinguished from each other in this location, the risk of flooding from this flood source is considered to be high.

15.3.33 As the temporary works within the foreshore would be located within functional floodplain and therefore Flood Zone 3b, and as the tidal and fluvial floodplain cannot be distinguished from each other in this location, the risk of flooding from this flood source is considered to be very high.

Fluvial flood risk from the proposed development

15.3.34 Fluvial influences were also considered when developing the hydraulic modelling summarised in para. 15.3.29. Overall, the results of the modelling exercise show that the proposed project-wide 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.

Surface water flood risk to the proposed development

15.3.35 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.

15.3.36 As part of the Drain London Project[iv] , a *Surface Water Management Plan (SWMP)* has been prepared for the LB of Wandsworth (Scott Wilson Ltd, 2011)[10]. This shows that the Kirtling Street site and adjacent areas are not located within a Critical Drainage Area[v], which indicates that the site is relatively less susceptible to surface water flooding than other local areas in the borough. Modelling results for a 1 in 100 year (0.1% AEP) rainfall event plus climate change allowance showed potential surface water flooding of 0.1m-0.25m deep in small sections to the south of the site.

[iv] a London-wide strategic surface water management study undertaken by the Greater London Authority (GLA) and London Councils

[v] Area susceptible to surface water flooding

15.3.37 The site area is hard standing and slopes towards the south west. Cringle Street slopes towards the east and Nine Elms Lane. Across the site the elevation of Cringle Lane decreases from 4.5mAOD to 3.8mAOD. Kirtling Street slopes towards the north, with elevations rising from 4.3mAOD in the south to 5.1mAOD to the north of Kirtling Street. Ground levels adjacent to the site appear to be comparable. There is therefore no clear overland flow route towards the site.

15.3.38 Kirtling Wharf (also known as Cringle Wharf), at the north west of the site, is currently being used as a concrete batching plant. Surface water generated over this area is currently drained to a series of sumps and is subsequently pumped to settlement tanks. This water is re-used for the operation of the batching plant, with excess water being drained to the combined sewers in Kirtling Street. Surface water from the remainder of the site is discharged to the tidal Thames through an existing outfall.

15.3.39 Surface water in the roads within the Kirtling Street site drain into the existing combined sewer network.

15.3.40 As the site and adjacent areas are located in an area shown to have potential flooding depths <0.25m and pathways are away from the site, the risk associated with this flood source is low (see methodology in Vol.2).

Surface water flood risk from the proposed development

15.3.41 An assessment of the likely significant effects of surface water from the Kirtling Street site is provided in Section 14 of this volume.

15.3.42 The NPS requires that surface water runoff on new developments is effectively managed so that the risk of surface water flooding to the surrounding area is not increased. In accordance with the NPS, runoff rates following the proposed development should not be greater than the existing (pre-development) rates.

15.3.43 Drainage from the north-western section of the site where the permanent works would be contained consists of foul and storm sewer connections at the north-western corner of Kirtling Street from the concrete batching plant. Surface water generated over this area is currently drained to a series of sumps and is subsequently pumped to settlement tanks. This water is re-used for the operation of the batching plant, with excess water being drained to the combined sewers in Kirtling Street.

15.3.44 There would not be an increase in the total impermeable area as a result of the proposed works and as the operational part of the site would fall entirely within the concrete batching works, surface water drainage would need to tie in to the existing drainage system and site. This would ensure that surface water runoff is not increased over existing rates and the appropriate water treatment/re-use measures are implemented.

15.3.45 Following the implementation of the above drainage measures the risk of flooding from the development to the surrounding area is considered to be unchanged and would remain as low.

Groundwater flooding risk to the proposed development

15.3.46 Groundwater flooding occurs where groundwater levels rise above ground surface levels.

15.3.47 Groundwater levels have been recorded by Thames Water for the nearest borehole SA1084 between May 2009 and July 2011 (located within 70m of the site). At this location the water levels in the upper aquifer, the river terrace deposits, is approximately 4m below ground level (bgl). This level is above that of the river terrace deposits (at 6m bgl at this site), suggesting that the upper aquifer is confined at this location by the overlying alluvium.

15.3.48 As the upper aquifer is confined, there is no pathway for groundwater to reach the surface of the site. There is therefore no risk of groundwater flooding to the site.

Groundwater flood risk from the proposed development

15.3.49 An assessment of the likely effects on groundwater at the Kirtling Street site is provided in Section 13 of this volume

15.3.50 The drive shaft would pass through made ground, Alluvium, river terrace deposits, London Clay, Harwich Formation and the Lambeth Group. Dewatering is anticipated to be required for the lower aquifer. Groundwater brought to the surface as a result of dewatering during construction would be pumped from the construction site to the tidal Thames after treatment.

15.3.51 The presence of the main tunnel drive shaft creating a physical barrier has been assessed as having a predicted rise in water levels (approximately 0.4m); however, this would result in increased hydraulic pressure within the confined unit rather than an increase of the water table. Therefore, there is no pathway for groundwater to reach the surface of the site. There is therefore no increase in groundwater flooding to the site as a result of the development.

Sewer flood risk to the proposed development

15.3.52 Sewer flooding arises when the capacity of the local sewer network is exceeded or a problem arises such as a blockage or fracture.

15.3.53 A combined sewer (1070mm by 610mm) runs eastward along Cringle Street connecting to the Low Level Sewer No. 1 South. A combined sewer (600mm diameter) runs northwards along Kirtling Street before connecting with the Cringle Street combined sewer. To the north of Cringle Street a 300mm diameter combined sewer runs along Kirtling Street before connecting to the Cringle Street sewer to the east. Several surface water drains and gullies connect to the combined sewers in Cringle Street and Kirtling Street.

15.3.54 Drainage from the north-western section of the site where the permanent works would be contained consists of foul and storm sewer connections at the north-western corner of Kirtling Street from the concrete batching plant.

15.3.55 Two combined sewers; Heathwall trunk sewer (1905mm diameter) and the southern Low Level Sewer No. 1 (1600mm diameter) run in a south-west to north-east direction along Nine Elms Lane. The Cringle Street sewer connects to the southern Low Level Sewer No. 1, east of the Kirtling Street site. Manholes along the Low Level Sewer No. 1 and Heathwall Trunk sewer are located to the east and south of the Kirtling Street site.

15.3.56 Should the capacity of the combined sewers be exceeded, water would surcharge through gullies along the reach of the sewer. The topography of the site suggests that any surcharged water from the Kirtling Street sewers would flow southward along Kirtling Street towards Cringle Street. Cringle Street slopes roughly west to east towards Nine Elms Lane.

15.3.57 Thames Water flooding records (Thames Water, 2012)[11] show that there have been three records of sewer flooding within 200m of the site since 1990.

15.3.58 As there is no direct pathway present within the vicinity of the site, the flood risk from this source is considered to be low.

Sewers flood risk from the proposed development

15.3.59 No sewers would be intercepted by the tunnel at this site therefore the sewer flood risk from the development would be unchanged.

Artificial sources flood risk to and from the proposed development

15.3.60 There are no nearby artificial flood sources eg, canals, reservoirs, which could lead to flooding of the site.

15.3.61 The risk from this source both to and from the proposed development is not applicable at this site and therefore has not been assessed further.

15.4 Design measures

15.4.1 Design measures have been incorporated into the design of the proposed development to ensure that the risk of flooding to and from the site and surrounding area is not increased during the construction and operational phases. These measures are described below although many have already been referred to in the preceding section.

Tidal and fluvial

Construction

Flood defences

15.4.2 The proposed tunnel alignment passes underneath the existing defences at two points in the immediate vicinity of the Kirtling Street site and would have the potential to affect the integrity of these defences. During construction the level of the flood defences at the site would be monitored, and where required repairs would be made to ensure crest heights of the flood defences at the site are maintained to the existing levels. With this strategy in place, no effects of settlement are anticipated.

15.4.3 Design measures to preserve the structural stability of the flood defences at the site would be dependent on the contractor's construction methodology. Potential options may include mplementing a load restriction zone to the rear of part of the wall, and where this is not possible, constructing a load-relieving platform and/or a temporary berm on the foreshore. Potential measures for the section of wall affected by diaphragm wall construction may include local strengthening works.

15.4.4 As discussed in para. 15.3.22 the use of an overhead conveyor to transport material from the barges into the site would require the protection and monitoring of the structural integrity of the defences to ensure that the walls are able to take potential loadings (applied or accidental). These would be included within the CoCP as a result of protection of existing infrastructure. These measures would be outlined as part of any flood defence consent.

15.4.5 Appropriate Protective Provisions would be agreed with the EA for any works within 16m of the flood defences on the landward side and within the river.

Scour management

15.4.6 During construction the formation of scour would be monitored and mitigation proposed if the scour exceeds agreed trigger values.

15.4.7 Mitigation options could include riprap or rock fill, articulated concrete blocks, gabion mattresses and grout filled mattresses. The detailed approach to the implementation of these mitigation measures would be informed by the monitoring results as well as site specific design requirements. Further details are provided in *Scour Monitoring and Mitigation Strategy* (Vol 3 Appendix L.4).

Emergency plan

15.4.8 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 at the site or a failure of the Thames Barrier. Further information is included within the CoCP (Section 8).

Surface water

Construction

15.4.9 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 (for example due to risk of blockage due to excessive sediment loads), the site would be drained such that accumulating surface water would be directed to holding or settling tanks, separators and other measures prior to discharge to the combined or surface water drains. Foul drainage from the site welfare facilities would be connected to the mains foul or combined sewer. 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

15.4.10 As discussed in para. 15.1.1 there would not be an increase in the total impermeable area as a result of the proposed works. The operational part of the site would fall entirely within the concrete batching works and as such, surface water drainage would need to tie in to the existing drainage system and site. This would ensure that surface water runoff is not increased over existing rates and the appropriate water treatment/re-use measures are implemented, as per existing conditions.

Groundwater

Construction and operation

15.4.11 Groundwater monitoring is proposed during construction and operation. Groundwater resulting from the dewatering of the lower aquifer during construction would be pumped to the tidal Thames. Further related design measures regarding dewatering and maintaining groundwater levels are described in Section 13 of this volume.

Sewers

Construction and operation

15.4.12 No sewers would be intercepted by the tunnel at this site therefore the sewer flood risk from the development would be unchanged and no further design measures are necessary.

15.5 Assessment summary

Flood risk

15.5.1 The permanent site area of the Kirtling Street site is located in Flood Zone 3a associated with the tidal Thames and benefits from the presence of flood defences ie, river wall. Within the tidal foreshore (Flood Zone 3b) a temporary jetty and conveyor would be constructed for the loading and unloading of material.

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 14 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 flooding in the event of a breach in the local flood defence wall along the edge of the tidal Thames 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 measures above those outlined above are proposed. Further detail is provided in Vol 3 Section 15 Project-wide effects.

Residualr from the development

15.5.7 Following the incorporation of the design measures outlined in Vol 14 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 14 Table 15.5.1 Flood risk – FRA summary

Source	Pathway	Current flood risk to the proposed development	Design measures	Flood risk from the proposed development (post design measures)	Flood risk to the proposed development post design measures
Tidal	tidal Thames	Main site – high (but residual) Jetty – Very high	Flood Defence height maintained. Access to pier over defences. Scour management a monitor and mitigate approach. 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 risk is residual only)
Fluvial	tidal Thames	Main site – high (but residual) Jetty – Very high	Flood Defence height maintained. Access to pier over defences. Scour management a monitor and mitigate approach. 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)
Surface water	Surrounding area	Low	Surface water discharged into existing drainage system.	No increase in surface water flood risk as a result of proposed development.	Low

Source	Pathway	Current flood risk to the proposed development	Design measures	Flood risk from the proposed development (post design measures)	Flood risk to the proposed development post design measures
Groundwater	Underlying geology and groundwater levels restricted pathway	No risk	Dewatering during construction. Monitoring proposed during construction and operational.	No increase in groundwater flood risk as a result of proposed development.	No risk
Sewers	Local drainage system	Low	No changes proposed.	No increase in sewers flood risk as a result of proposed development.	Low
Artificial sources	None	Not applicable	Not applicable	Not applicable	Not applicable

** Definitions of these classifications are included in Vol 2*
() indicate the flood risk is residual ie in the event of a failure or overtopping of flood defences

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[11] Thames Water. *Sewer Flooding Records.* (received June 2012)

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