LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA4 | Kilburn (Brent) to Old Oak Common

November 2013

VOL 2

ES 3.2.1.4

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Department for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

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Structure of the HS2 Phase One Environmental Statement

The Environmental Statement (ES) documentation comprises:

- Non-technical summary (NTS) - which provides a summary in non-technical language of the Proposed Scheme, the likely significant environmental effects of the Proposed Scheme, both beneficial and adverse, and the means to avoid or reduce the adverse effects;
- Volume 1: Introduction to the Environmental Statement and the Proposed Scheme. This describes High Speed Two (HS2), and the environmental impact assessment process, the approach to consultation and engagement, details of the permanent features and generic construction techniques as well as a summary of main strategic and route-wide alternatives and local alternatives (prior to 2012) considered;
- Volume 2: Community forum area reports and map books - 26 reports and associated map books providing a description of the Proposed Scheme and of environmental effects in each area;
- Volume 3: Route-wide effects - provides an assessment of the effects of the Proposed Scheme where it is not practicable to describe them within the CFA descriptions in Volume 2;
- Volume 4: Off-route effects - provides an assessment of the off-route effects of the Proposed Scheme;
- Volume 5: Appendices and map books - contains supporting environmental information and associated map books; and
- Glossary of terms and list of abbreviations - contains terms and abbreviations, including units of measurement, used throughout the ES documentation.

1 Introduction

1.1 Introduction to HS2

1.1.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester, South Yorkshire and the East Midlands will be served by high speed trains running at speeds of up to 360kph (225mph).

1.1.2 HS2 is proposed to be built in two phases. Phase One, the subject of this ES, will involve the construction of a new railway line of approximately 230km (143 miles) between London and Birmingham. Construction will begin in 2017 and the line will become operational by 2026; with a connection to the West Coast Main Line (WCML) near Lichfield and to the existing HS1 railway line in London.

1.1.3 During Phase One beyond the dedicated high speed track, high speed trains will connect with and run on the existing WCML to serve passengers beyond the HS2 network to destinations in the north. A connection to HS1 will also allow some services to access that high speed line through east London and Kent and connect with mainland Europe via the Channel Tunnel.

1.1.4 Phase Two will involve the construction of lines from Birmingham to Leeds and Manchester; with construction commencing approximately 2023, and planned to be operational by 2033.

1.1.5 Section 4 of Volume 1 describes the anticipated operational characteristics of HS2, including the anticipated frequency of train services. As Volume 1 shows, the frequency of trains is expected to increase over time and to increase further upon opening of Phase Two. In assessing the environmental effects of the Proposed Scheme the anticipated Phase 2 operational frequency has been used. For further detail of the anticipated operation of the Proposed Scheme in the Kilburn (Brent) to Old Oak Common (CFA4), see Section 2.4.

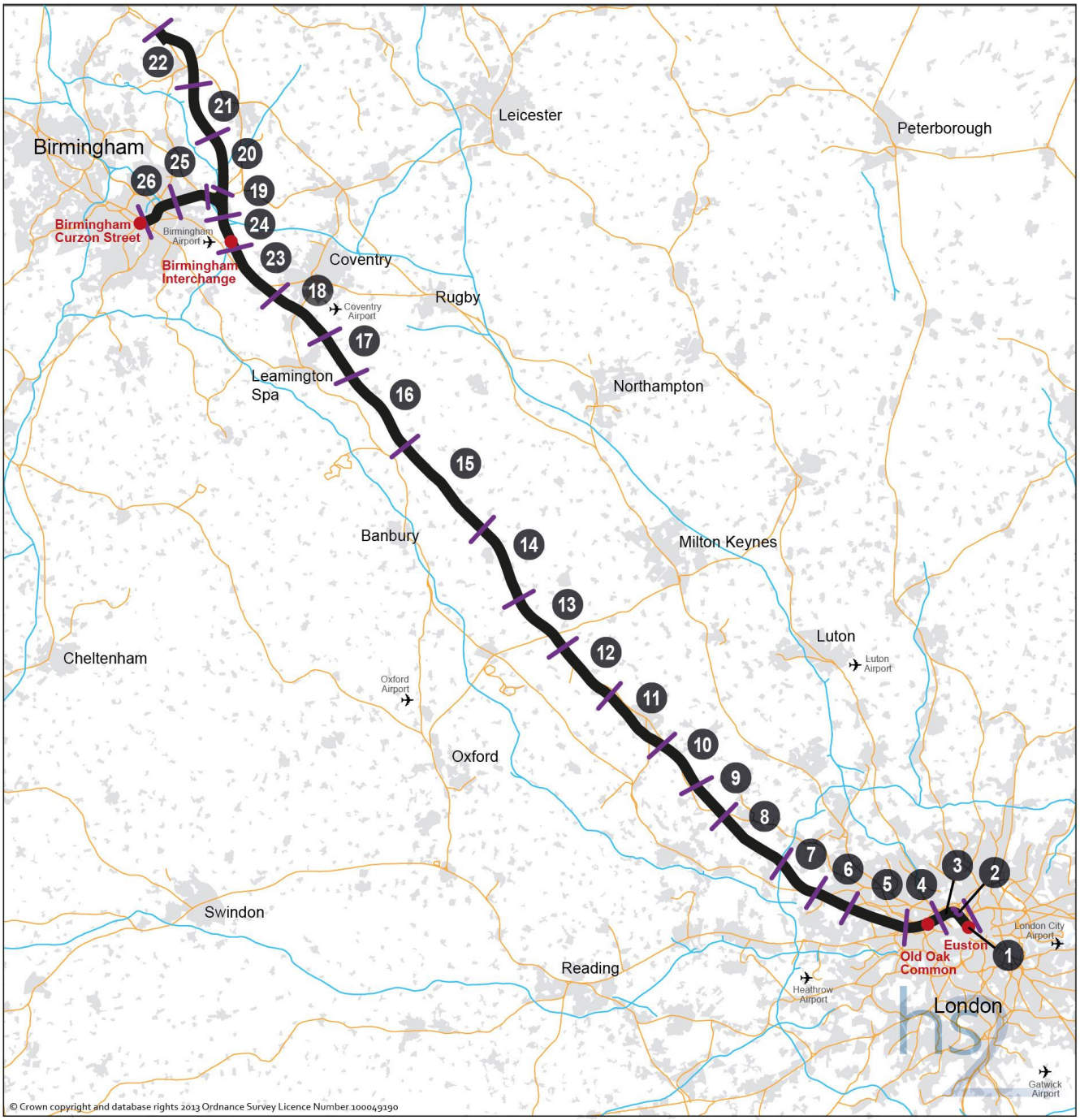
1.1.6 The Government believes that the HS2 network should link to Heathrow and its preferred option is for this to be built as part of Phase Two. However, the Government has since taken the decision to pause work on the Heathrow link until after 2015 when it expects the Airports Commission to publish its final report on recommended options for maintaining the country's status as an international aviation hub.

1.1.7 For consultation and environmental assessment purposes, the proposed Phase One route has been divided into 26 community forum areas (CFA), as shown in Figure 1. This has enabled wider public engagement on the Proposed Scheme design and on the likely adverse and beneficial effects.

1.2 Purpose of this report

1.2.1 This CFA report presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment within the area of Kilburn (Brent) to Old Oak Common (CFA4). The report describes mitigation measures that are proposed for the purpose of avoiding, reducing or managing the likely significant adverse effects of the Proposed Scheme on the environment within the Kilburn (Brent) to Old Oak Common area.

Figure 1: HS2 Phase One route and community forum areas



Community forum areas

1. Euston - Station and Approach
2. Camden Town and HS1 Link
3. Primrose Hill to Kilburn (Camden)
4. Kilburn (Brent) to Old Oak Common
5. Northolt Corridor
6. South Ruislip to Ickenham
7. Colne Valley
8. The Chalfonts and Amersham
9. Central Chilterns
10. Dunsmore, Wendover and Halton
11. Stoke Mandeville and Aylesbury
12. Waddesdon and Quainton
13. Calvert, Steeple Claydon, Twyford and Chetwode
14. Newton Purcell to Brackley
15. Greatworth to Lower Boddington
16. Ladbroke and Southam
17. Offchurch and Cubbington
18. Stoneleigh, Kenilworth and Burton Green
19. Coleshill Junction
20. Curdworth to Middleton
21. Drayton Bassett, Hints and Weeford
22. Whittington to Handsacre
23. Balsall Common and Hampton-in-Arden
24. Birmingham Interchange and Chelmsley Wood
25. Castle Bromwich and Bromford
26. Washwood Heath to Curzon Street

- HS2 station
- Proposed Phase One route
- CFA boundary
- Existing railways
- Motorways
- Airports

N

0 — 20 km approx

1.3 Structure of this report

1.3.1 This report is divided into the following sections:

- Section 1 - an introduction to HS2 and the purpose and structure of this report;
- Section 2 - overview of the area, description of the Proposed Scheme within the area and its construction and operation, and a description of the main local alternatives; and
- Sections 3-13 - a summary of the assessment for the following environmental topics:
  - agriculture, forestry and soils (Section 3);
  - air quality (Section 4);
  - community (Section 5);
  - cultural heritage (Section 6);
  - ecology (Section 7);
  - land quality (Section 8);
  - landscape and visual assessment (Section 9);
  - socio-economics (Section 10);
  - sound, noise and vibration (Section 11);
  - traffic and transport (Section 12); and
  - water resources and flood risk assessment (Section 13).

1.3.2 Each environmental topic section comprises: an introduction to the topic; a description of the environmental baseline within the area; the likely significant environmental effects arising during construction and operation of the Proposed Scheme; and proposed mitigation measures for any significant adverse effects.

1.3.3 Environmental effects have been assessed in accordance with the methodology set out in Section 8 of Volume 1, the Scope and Methodology Report (SMR) (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2).

1.3.4 Where appropriate, potential climate change impacts and adaptation measures are discussed in the relevant environmental topic section. Sections 7 and 9 of Volume 1 and the SMR Addendum in Volume 5 also include additional information about climate change adaptation and resilience.

1.3.5 Maps relevant to Kilburn (Brent) to Old Oak Common are provided in a separate corresponding document entitled Volume 2: CFA4 Map Book, which should be read in conjunction with this report.

1.3.6 The Proposed Scheme described in this report is that shown on the Map Series CT-05 (construction) (Volume 2, CFA4Map Book) and CT-06 (operation) (Volume 2, CFA4 Map Book). There is some flexibility during detailed design to alter the horizontal and vertical alignments and other details within the limits shown on the plans and sections submitted to Parliament and as set out in the Bill. This flexibility is included within the scope of the environmental assessment. Further explanation is provided in Volume 1, Section 1.

1.3.7 In addition to the environmental topics covered in Sections 3-13 of this report, electromagnetic interference is addressed in Volume 1, Section 7 and climate (greenhouse gas emissions and carbon), and waste and material resources are addressed in Volume 3. An assessment of potential environmental effects beyond the CFA has also been undertaken and this 'off-route' assessment is reported in Volume 4.

2 Overview of the area and description of the Proposed Scheme

2.1 The Strategic Case for Old Oak Common station

Transport planning case

2.1.1 The Department for Transport's publication High Speed Rail: Investing in Britain's Future[1] confirmed the choice of Old Oak Common as the site for a London interchange for HS2, and as best serving passenger requirements including onwards travel. At Old Oak Common, passengers will be able to transfer to Crossrail, Heathrow Express (HEx), the Great Western Main Line (GWML) and other local public transport. A direct link to HS1 will allow trains to run from the main high speed line at Old Oak Common directly onto HS1, without the need to transfer between trains.

2.1.2 Transport demand forecasts have demonstrated that the majority of the passengers travelling to and from London on HS2 will wish to travel to and from the central London terminus at Euston. However, the option to interchange at Old Oak Common with Crossrail will provide opportunities for quicker access to parts of the West End, the City and Canary Wharf than changing at Euston. This enhanced integration will further reduce end-to-end journey times, e.g. ultimately bringing Leeds and Manchester within 1 hour and 40 minutes of Canary Wharf at completion of HS2 Phase 2. The Old Oak Common station also will provide a rail connection to Heathrow airport for passengers interchanging with Crossrail services.

2.1.3 In 2026, it is forecast that there will be demand from over 3,000 HS2 passengers and nearly 18,000 rail passengers in total to use the new Old Oak Common station in the morning peak hour, either to change trains or to start or finish their journeys. By 2041, this total will reach 34,000, of which 5,000 will be using HS2. The Proposed Scheme at Old Oak Common station will provide good interchange with Crossrail, local and longer-distance rail services and local bus services, and is being designed to efficiently accommodate the 2041 passenger forecasts. Without HS2 and the interchange that will be possible at Old Oak Common station, Euston station, West Coast Main Line and other national rail services, and the London Underground will be unable to meet the demand in 2026, even if further incremental improvements to capacity were made.

2.1.4 Approximately a third of HS2 passengers will use Old Oak Common to change onto Crossrail to travel into central London, in preference to staying on until Euston. In addition to providing better journeys for these passengers, this will also reduce the number of passengers moving within Euston and its London Underground connections.

[1] Department for Transport (2012) *High Speed Rail: Investing in Britain's Future - Decisions and Next Steps. London*, the Stationery Office.

2.1.5 Old Oak Common station will also act as a stop for international trains using HS1. The HS1-HS2 Link connecting Old Oak Common station to HS1 will also allow international trains to use the HS2 route, and allow international services to be run to and from the West Midlands, and ultimately from Manchester and Leeds without stopping at St. Pancras International or Euston stations. Old Oak Common therefore will provide the stop in London for these international services. This will enable direct high speed services from across Britain to mainland European destinations via the Channel Tunnel. Birmingham will be a little over three hours from Paris, and in the longer term journey times from Manchester and Leeds will be around three hours and 40 minutes (in Phase Two).

Regeneration case

2.1.6 Developments such as Canary Wharf and King's Cross Central have already shown how a long standing regeneration area can swiftly be physically and socially transformed by major businesses and institutions, together with residential developers and service providers. These stakeholders have all recognised the benefits of proximity to each other and the radically improved transport facilities on the edge of central London. Providing an interchange between HS2 and other public transport services at Old Oak Common station will provide another such opportunity. This principle is supported by the Greater London Authority (GLA) and the relevant local borough councils in London through their planning policies as set out in the London Plan 2011[2], the Mayor's Transport Strategy[3], the Park Royal Opportunity Area Planning Framework[4] and the recently published 'Vision for Old Oak'[5].

2.1.7 The London Plan seeks to integrate transport and development throughout London, particularly at locations such as Old Oak Common, which will have high public transport accessibility in the future. HS2 is a key scheme in the London Plan's Indicative List of Transport Schemes and is identified as a strategic priority which will "*support future development and regeneration priority areas, and increase public transport capacity*".

2.1.8 The Park Royal area, encompassing Old Oak Common, is identified in the London Plan as an 'opportunity area' with significant capacity to accommodate new housing, commercial and other development linked to existing or potential improvements to public transport accessibility.

2.1.9 Annex 1 of the London Plan outlines the broad principles to be applied to the Park Royal/Willesden Junction Opportunity Area. Table A1.1 sets out an indicative estimate of 14,000 jobs and a minimum of 1,500 new homes to 2031 in this location. This recognises

[2] Greater London Authority (2011), *The London Plan: Spatial Developments Strategy for Greater London*.
[3] Greater London Authority (2010), *Mayor's Transport Strategy*.
[4] Greater London Authority (2011), *Adopted Park Royal Planning Framework.*
[5] LB Brent (et al) (2013) *Old Oak: A Vision for the Future*.

that Park Royal/Willesden Junction and adjacent areas are underused and have potential for intensification.

2.1.10 The key objective of the adopted Opportunity Area Planning Framework is *"to protect and maintain Park Royal as the largest industrial employment location in London, supporting the clusters of food/drink, distribution/logistics and TV/film through facilities and services to support growth*". The Framework recognises that Old Oak Common has been identified as having potential for a new HS2 and Crossrail interchange which will require a reconsideration of the area's current designation as strategic industrial land (SIL).

2.1.11 The London Borough of Hammersmith and Fulham (LBHF), London Borough of Ealing (LBE) and London Borough of Brent (LBB) have been working with the GLA and Transport for London (TfL) to produce the 'Vision for Old Oak' which, on adoption by the GLA as a future Opportunity Area Planning Framework, will inform revisions to local planning policy. In reconsidering the area's role, and the potential opportunities that a HS2 interchange station will create, the GLA launched consultation on this document in June 2013. This recognises that Old Oak Common could be one of the best connected railway stations in the UK, giving rise to the transformation of the area with up to 90,000 jobs and up to 19,000 new homes, schools, open spaces, shops and leisure facilities[6]. The consultation on the 30 year vision for Old Oak closed on 6 September 2013.

Local Policy

2.1.12 Currently, the LBHF Adopted Core Strategy[7] promotes the Old Oak Common sidings and the former North Pole depot as a major rail interchange between HS2, Crossrail, the GWML and the West London Line (WLL) and North London Line (NLL). In the longer term, the Council is promoting the Old Oak Common sidings (Strategic Site PR1) for mixed use development, including significant residential development and support for passenger rail services as part of a potential HS2/Crossrail interchange station (i.e. the proposed Old Oak Common station). The whole area is also designated under Strategic Policy B of the LBHF Adopted Core Strategy, as an employment zone/SIL for a range of purposes (especially industrial, distribution, office-based, research and development, recycling and the management of waste). The policy states that if the Crossrail interchange for HS2 at Old Oak Common is to be provided, the Council will undertake a more detailed study into the development potential of the Old Oak Common sidings and Hythe Road area. This will involve further consultation on planning policies for the area.

[6] LB Brent (et al) (2013) *Old Oak: A Vision for the Future.*
[7] Hammersmith and Fulham London Borough Council (2011), *London Borough of Hammersmith and Fulham Adopted Core Strategy*.

2.1.13 Policy 1.2 (e) of Ealing Council's adopted Core Strategy supports the opportunities that will arise from Crossrail and HS2 and seeks to ensure the benefits to the borough are maximised[8].

2.1.14 HS2 Ltd. will continue to work with the relevant councils, the GLA and other stakeholders, including Network Rail (NR) and other landowners, to explore the opportunities for development in the area surrounding Old Oak Common station, and associated development opportunities that will arise from the Proposed Scheme. Land around the station that will be required only for the construction phase may become available after construction for development.

2.2 Overview of the area

2.2.1 The Kilburn (Brent) to Old Oak Common CFA covers approximately 5.4km of the Proposed Scheme. It extends from the A5 Kilburn High Road in the east to the B4492 Park Royal Road in the west. This section of the Proposed Scheme includes a new station at Old Oak Common which will act as an interchange between the new high speed railway lines and the GWML, HEx and Crossrail services. There will also be a crossover box at Victoria Road which will allow trains to change tracks and reverse in and out of the station. The remainder of the route in this section lies within tunnel.

2.2.2 The areas of Kilburn, Kensal Rise and Kensal Green lie to the north of the route and West Kilburn to the south, as shown on Maps CT-10-004b and CT-10-005 (Volume 2, CFA4 Map Book).The route lies partly within five London boroughs: the London Borough of Brent (LBB); the Royal Borough of Kensington and Chelsea (RBKC); the City of Westminster (CoW); the London Borough of Hammersmith and Fulham (LBHF); and the London Borough of Ealing (LBE).

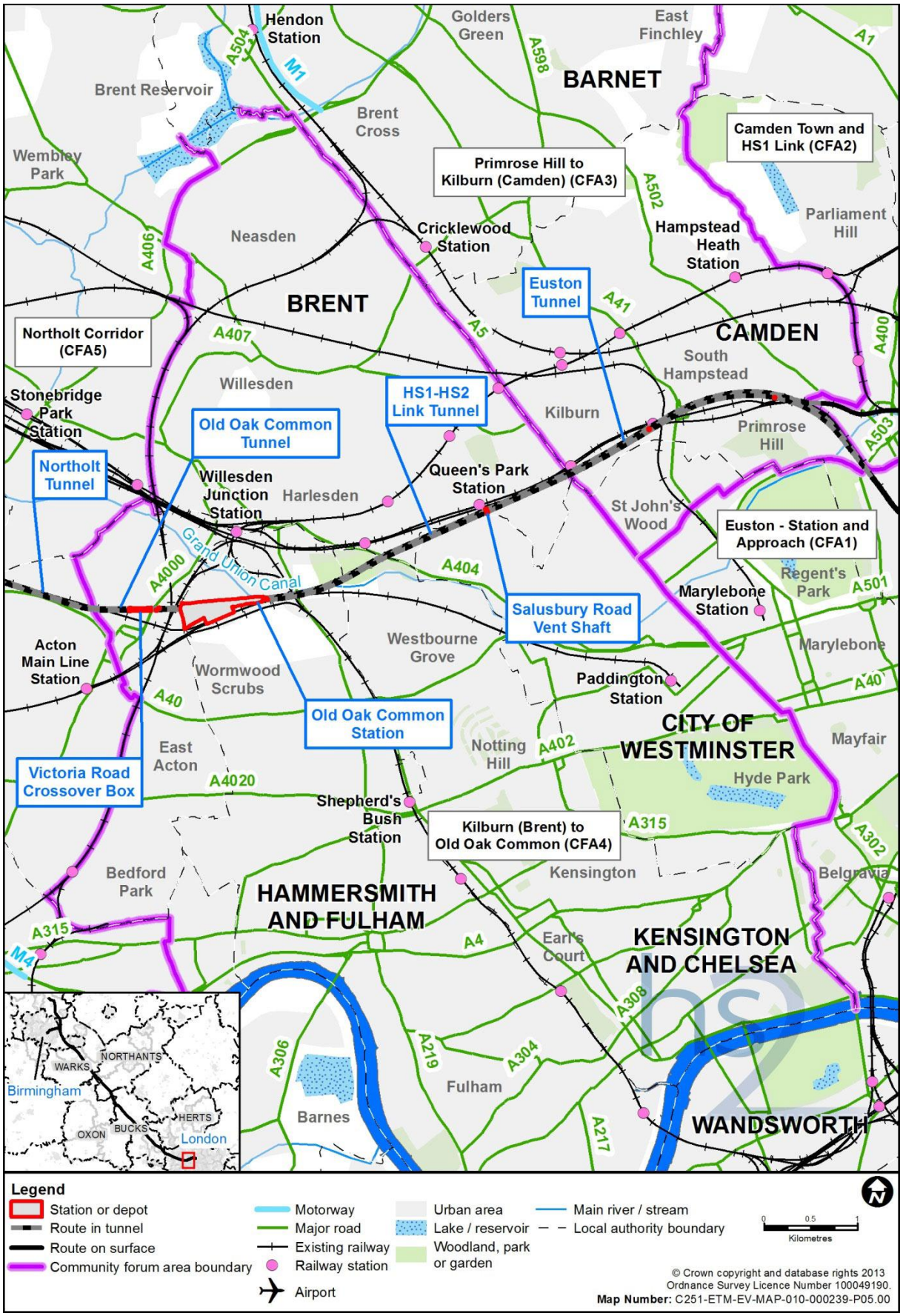
2.2.3 The Primrose Hill to Kilburn (Camden) area (CFA3) lies to the east and the Northolt Corridor area (CFA5) lies to the west, as shown in Figure 2.

Settlement, land use and topography

2.2.4 The areas to the north of the route are mainly residential, and include the open spaces of Queen's Park and Paddington Cemetery. To the south, West Kilburn mainly comprises terraced housing and the extensive South Kilburn Estate. In the west of the area is Kensal Green Cemetery, the Grand Union Canal (Paddington Branch) and land that is currently occupied by rail depots and extensive railway sidings (the site of the proposed Old Oak Common station). The western end of the route passes through the Park Royal employment area, characterised by industrial and retail units. Willesden Junction station is located to the north-west of the route. The open spaces of Wormwood Scrubs and Little Wormwood Scrubs lie to the south.

[8] Ealing Council (2012), *London Borough of Ealing Adopted Development (of Core) Strategy.*

Figure 2: Area context map



Key transport infrastructure

2.2.5 A number of railway lines pass through this area, including:

- the West Coast Main Line (WCML), which is located to the north of the route, and provides services between London Euston, Birmingham, the north-west of England and Glasgow;
- the GWML, which is located to the south of the area, passing through Old Oak Common, and provides main line services between London Paddington, the west and south-west of England and the south of Wales;
- the HEx, which links Paddington directly to Heathrow Airport;
- the Acton to Northolt Line (ANL), which links London Paddington and West Ruislip, crosses the route at North Acton. The current passenger service is only one train a day in one direction, on Mondays to Fridays. Occasional freight services also use this line;
- the Cricklewood to Acton Wells Line, which provides a freight only link from Cricklewood to Acton Wells Junction and a link to the Acton Canal Wharf to Willesden Line, crosses the route at North Acton;
- two branches of the London Overground network; the West London Line (WLL) provides links between Willesden Junction and Clapham Junction; and the North London Line (NLL) provides links between Willesden Junction and Richmond crosses the route at Old Oak Common; and
- the London Underground Central line crosses the route at North Acton, at the boundary with CFA5. The London Underground Bakerloo line crosses the route at Kilburn Park, close to the CFA's eastern boundary, serving a number of stations in the area.

2.2.6 In addition to these operational railway lines there are a number of key railway infrastructure facilities including:

- the HEx and First Great Western (FGW) depot facilities at Old Oak Common;
- the North Pole depot which supports the Intercity Express Programme, located to the south of Old Oak Common; and
- the future Crossrail depot, currently being built on railway lands to the north of Old Oak Common.

2.2.7 Principal highways within this area include the A404 Harrow Road, A219 Scrubs Lane and A4000 Victoria Road, as shown in Figure 2: Area context map.

2.2.8 The Grand Union Canal creates a linear corridor running from east to west through the area. It is used by recreational craft and has regional historical significance for London. The adjacent canal towpath is used by walkers and cyclists.

2.2.9 There are no designated footpaths and bridleways in the area although there are rights of way on pavements alongside public highways (public rights of way (PRoW))[9].

Socio-economic profile

2.2.10 To provide a socio-economic context for the area, data for the following demographic character areas (DCA) have been used: Kilburn; and Old Oak Common[10]. In total, the population of the DCAs is approximately 83,200. Unemployment in the area is 10.0% which is higher than the national level of 7.4%, while approximately 72% of the population aged 16-74 is economically active compared to the national figure of approximately 70%[11]. There are approximately 35,000 people who work within the area[12].

Notable community facilities

2.2.11 The main shops and services are located on A404 Harrow Road, College Road, the B414 Salusbury Road, Chamberlayne Road and the B413 Kilburn Lane. There are also neighbourhood shops distributed throughout the residential parts of the area.

2.2.12 The area includes 12 community halls/centres within the Kilburn (Brent) to Old Oak Common area and two libraries, located on Queen's Park Road and the B414 Salusbury Road.

2.2.13 Educational facilities in the area include five early-years educational facilities, eight primary schools and two secondary schools (St. George's Roman Catholic School and Bales College).

2.2.14 There are three doctors' surgeries, six medical centres and six dentist practices. The Queen Charlotte Hospital and Hammersmith Hospital are located within 1km of the route.

2.2.15 The area includes 14 religious facilities and/or places of worship. Paddington Cemetery, Kensal Green Cemetery, St. Mary's Roman Catholic Cemetery and Acton Cemetery are also located in close proximity to the proposed route.

Recreation, leisure and open space

2.2.16 The key recreational facilities within the area include:

- five sports/fitness centres at Albert Road, the B413 Kilburn Lane, Bruckner Street, Charteris Road and the B414 Salusbury Road;
- an outdoor running track (just outside the CFA boundary) at the Linford Christie Stadium at Wormwood Scrubs; and
- open and recreation space at Grand Union Canal, Wormwood Scrubs, Little Wormwood Scrubs and Queen's Park.

[9] For ease of discussion, PRoW has been used throughout the document to describe pavements alongside public highways.
[10] A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).
[11] Office for National Statistics (2012), *Census 2011,* Office for National Statistics, London.
[12] Office for National Statistics (2012), *Business Register and Employment Survey 2011*, Office for National Statistics, London.

Committed development

2.2.17 Developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme, are shown in Map Series CT-13 (Volume 5, Cross Topic Appendix 1 Map Book) and listed in Volume 5: Appendix CT-004-000. Except where noted otherwise in Volume 5: Appendix CT-004-000, it has been assumed that these developments will have been completed by 2017. These are termed 'committed developments' and have been taken into account for the purpose of assessing the likely significant environmental effects of the Proposed Scheme. Where these developments have a particular relevance to an assessment topic, this is noted in the future baseline section for that topic.

2.2.18 There is one major development in the Kilburn (Brent) to Old Oak Common area as shown on Map Series CT-13 (Volume 5, Cross Topic Appendix 1 Map Book). The development is CFA4/29: RBKC Kensal Gasworks Strategic Site Allocation. This is a proposed mixed use development at eight separate locations north and south of the route. For this allocation there are currently no existing applications relating to residential/office development and therefore up to 2,500 dwellings, office space and non-residential floorspace remain to be built out. However works are scheduled to decommission gas holders and progress decontamination. Such works (decommissioning/ decontamination and any subsequent development) are likely to occur after 2017, i.e. at the same time as the Proposed Scheme. Occupants of this site are considered receptors for the operation of HS2, but its development may potentially to give rise to cumulative construction impacts with the HS2 scheme.

2.2.19 CFA4/10 (LBB allocation SK1) and related outline application 12/0788 is located at Salusbury Road. The application is for a mixed use courtyard-type development including residential, community facilities (including the British Legion), retail, open space and a new bus interchange partly within the land required for the Salusbury Road vent shaft. HS2 Ltd is currently in discussions with LBB to determine whether this development can proceed in an amended form after the construction of the Proposed Scheme.

2.2.20 Planning applications yet to be determined and sites that are proposed allocations in development plans that have yet to be adopted, on or close to the Proposed Scheme, are termed 'proposed developments'. These are listed in Volume 5: Appendix CT-004-000. They are not included in the assessment. The progress of these proposals is being monitored.

2.3 Description of the Proposed Scheme

2.3.1 The following section describes the main features of the Proposed Scheme in the Kilburn (Brent) to Old Oak Common area, including the main environmental mitigation measures. Further generic information on typical permanent features is provided in Volume 1,

Section 5. Similarly, a general description of the approach to mitigation is set out in Volume 1, Section 9.

2.3.2 The Proposed Scheme will require some land on a permanent basis, key features of which are illustrated in Map Series CT-06 (Volume 2, CFA4 Map Book). Land that will also be required, but only on a temporary basis for construction, is illustrated in Maps CT-05-006b to CT-05-010a (Volume 2, CFA4 Map Book).

2.3.3 In general, in this CFA, features are described from east to west along the route (and south to north for features that cross the HS2 route).

2.3.4 Since the draft Environmental Statement was published the following changes have been introduced to permanent features of the Proposed Scheme:

- the size of the Salusbury Road auto-transformer station has increased in size from approximately 20m by 10m and at 4m above ground level, to its current proposed size of approximately 33m by 16m, with a height of approximately 5m. This change is due to the need to accommodate the equipment required. The change has reduced landscaping opportunities at the site; and
- the Victoria Road crossover box allows trains to change tracks and reverse in and out of the station. This provides the space required for functionality following the introduction of the Northolt tunnel. The crossover box is now proposed to be located between Chase Road and the A4000 Victoria Road. Refer to Section 2.6 for further detail.

Overview

2.3.5 The Proposed Scheme through the Kilburn (Brent) to Old Oak Common area will be approximately 5.4km in length and will commence at the A5 Kilburn High Road. The route section will be mainly in tunnel, as it proceeds south-west towards Old Oak Common. There will be a ventilation and intervention shaft (vent shaft) at Salusbury Road in Queen's Park. The route will continue westwards for a further 2.6km into a triangular site at Old Oak Common. Within the triangular site a new HS2 interchange station and associated infrastructure, known as Old Oak Common station, will be constructed. This site is bordered by Old Oak Common Lane and Wells House Road to the west, the GWML tracks and North Pole depot to the south and the future Crossrail depot, pending construction, to the north.

2.3.6 The work for Old Oak Common station requires the demolition of the HEx depot and the FGW depot which are currently based in this location. It is proposed to relocate these facilities to a section of the North Pole depot. Further details on the relocation of the HEx and FGW depots are provided in Volume 4.

2.3.7 Twin-bore tunnels will pass through the area between Euston station (in CFA1) to West Ruislip (in CFA6). The section of the route between Euston and Old Oak Common station

is referred to as the Euston tunnel. To the west of the Old Oak Common site, the Proposed Scheme will continue in short twin-bored tunnels (referred to as the Old Oak Common tunnel), beneath Wells House Road and will connect with the Victoria Road crossover box (a facility to allow HS2 trains to change tracks) and vent shafts located between Chase Road, to the west and the A4000 Victoria Road to the east. From here the route will continue west in twin bore tunnels beneath Acton Cemetery and will enter the adjacent Northolt Corridor area (CFA5) beneath the B4492 Park Royal Road. This tunnel to the west of the crossover box is known as the Northolt tunnel.

2.3.8 A single-bore tunnel will link Old Oak Common station to the HS1-HS2 Link portal located north-west of Primrose Hill (in CFA2). The HS1-HS2 Link will then proceed through Camden on a series of viaducts which currently carry the London Overground (NLL) and freight services to connect with the existing HS1 rail corridor.

2.3.9 The Map Series CT-06 (Volume 2, CFA4 Map Book) show the Proposed Scheme through the area.

Euston tunnel and HS1-HS2 Link tunnel

2.3.10 The section of the Euston tunnel which lies within CFA4 starts beneath the A5 Kilburn High Road and extends westwards to Old Oak Common station. The Euston tunnel will comprise twin-bore tunnels of approximately 7.6m internal diameter, 7.4km in overall length (approximately 3.6km within CFA4) and with a depth to rail level varying between about 15m (in the vicinity of the station and crossover box) and 44m (beneath Terrace Avenue in Kensal Rise).

2.3.11 The section of the HS1-HS2 Link tunnel which lies within CFA4 also starts beneath the A5 Kilburn High Road and extends westwards to Old Oak Common station. It is a single-bore tunnel within the Camden and HS1 Link area (CFA2). It will have an approximate 7.6m internal diameter, be 6.3km in overall length (approximately 3.5km within CFA4) and have a depth below ground level varying between about 15m and 44m.

2.3.12 The HS1-Hs2 Link tunnel runs between the two bores of the Euston tunnel. The tunnels will intersect with the Salusbury Road vent shaft and will continue onwards to Old Oak Common station. Cross passages between the tunnels will be provided at approximately 380m intervals.

2.3.13 Key permanent features of this section are illustrated on Map Series CT-06 (Volume 2, CFA4 Map Book).

Salusbury Road vent shaft

2.3.14 The Salusbury Road vent shaft will occupy a site currently used as a pay-and-display car park, a building currently used by London Underground Limited for staff welfare facilities and a vacant light industrial unit. The vent shaft will be approximately 43m by 19m. The

base of the vent shaft will be 41m below ground with foundations extending to approximately 51m below ground. The vent shaft will sit across the Euston tunnel and the HS1-HS2 Link tunnel. The vent shaft will provide passive and mechanical ventilation for the tunnels and will allow intervention and evacuation in the event of an emergency. Key features of this vent shaft will include (see Map CT-06-007, Volume 2, CFA4 Map Book):

- a permanent fenced compound, containing:
  - a shaft headhouse building, which will be approximately 43m by 19m and approximately 9.5m above existing ground level. It will provide access to tunnels below;
  - an area of hardstanding to allow for maintenance and emergency access and egress from the tunnel; and
  - an auto-transformer station to supply power for the trains. The auto-transformer station will be approximately 33m by 16m, with a height of approximately 5m.
- access via the B413 Kilburn Lane or the B414 Salusbury Road and Premier Corner.

Old Oak Common station and surrounding area

2.3.15 Old Oak Common station and associated infrastructure will be constructed on the site currently occupied by the FGW and HEx depots. The site is approximately 900m in length, bounded by the future Crossrail depot to the north, Old Oak Common Lane to the west, and the Intercity Express Programme depot to the south. An illustrative view of the station within the context of its surroundings (facing north-west) is shown in Figure 3. A larger print of this aerial visualisation is shown in figure LV-15-001 (Volume 2, CFA4 Map Book).

Figure 3: Aerial view of the Proposed Scheme at Old Oak Common station

2.3.16 Key features of the station and the surrounding area are shown on Maps CT-06-009a (Volume 2, CFA4 Map Book).

2.3.17 Old Oak Common station will contain six HS2 platforms located approximately 15m below its surrounding ground level providing domestic services and international services. The station will also provide an eight-platform interchange at ground level with GWML, HEx and Crossrail services.

2.3.18 Within the station retail, welfare and passenger information facilities will be provided. Emergency exits from the ground level platforms will be provided by footbridges at the platform ends.

2.3.19 The roof of the station building will be approximately 25m above its surrounding ground level. In addition there could be mechanical and electrical equipment on the station roof up to 5m high.

2.3.20 At the eastern end of the station there will be:

- an emergency intervention and evacuation shaft measuring approximately 4m above ground level to provide an escape route from the Euston tunnel;

- a vent shaft measuring approximately 8m above ground level to provide ventilation to the covered areas of the station and evacuation for maintenance staff; and
- a vent and emergency intervention and evacuation shaft measuring approximately 6m above ground level to provide an escape route from the station platforms.

2.3.21 At the western end of the station there will be:

- a vent and emergency intervention and evacuation shaft measuring approximately 6m above ground level to provide an escape route from the station platforms; and
- an emergency intervention and evacuation shaft measuring approximately 4m above ground level to provide an escape route from the Old Oak Common tunnel.

2.3.22 Illustrative block plans of the four main levels of the station show: the platform level (Figure 4); the passenger circulation arrangements at intermediate level (Figure 5); the bridge providing interchange access to the ground level platforms (Figure 6); and the above ground bridge level (Figure 7). Elevations and sections of Old Oak Common station are illustrated in Maps CT-20-011 and CT-20-012 (Volume 2, CFA4 Map Book).

Figure 4: Old Oak Common station block plan: below ground platform level

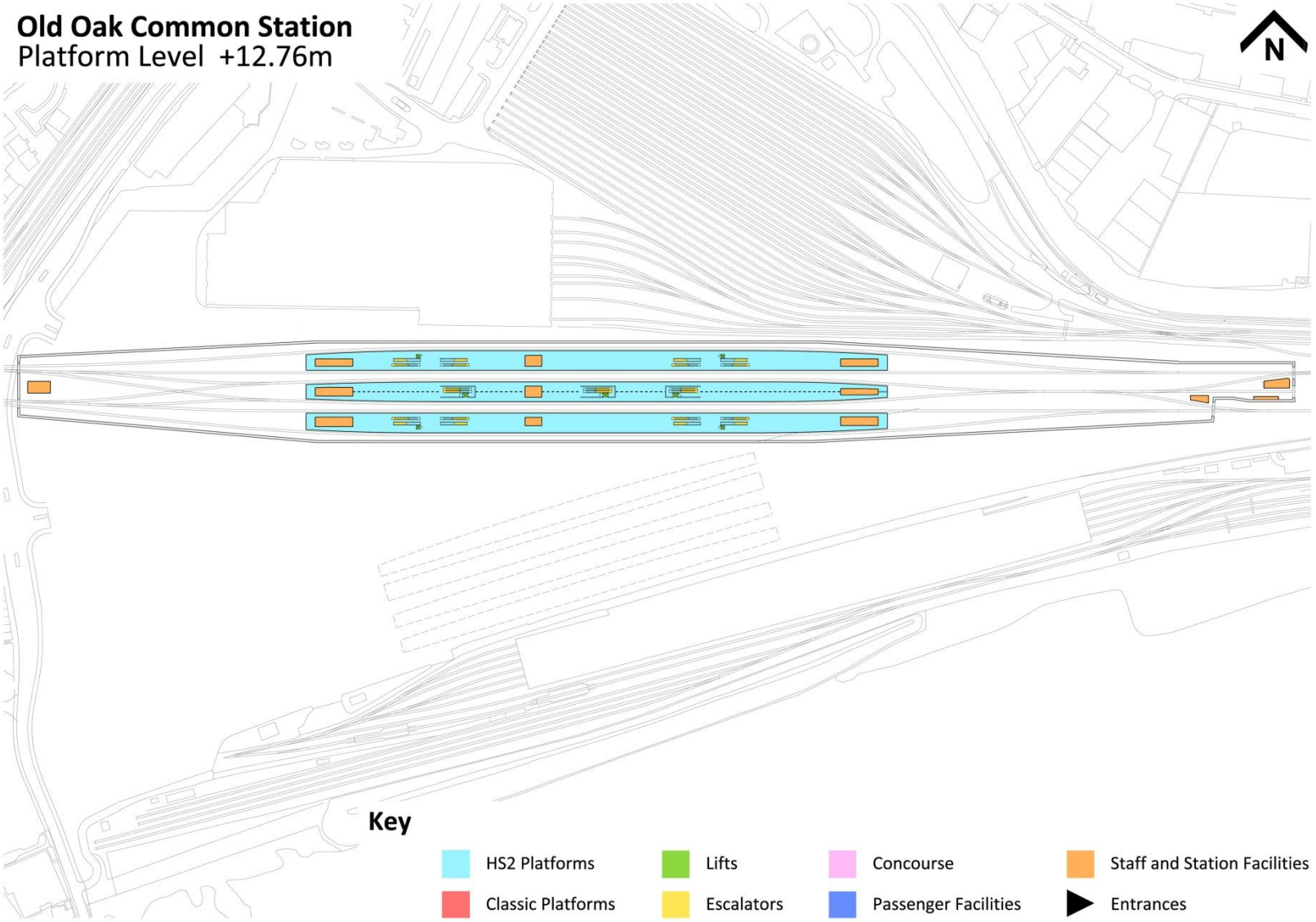


Figure 5: Old Oak Common station block plan: intermediate level

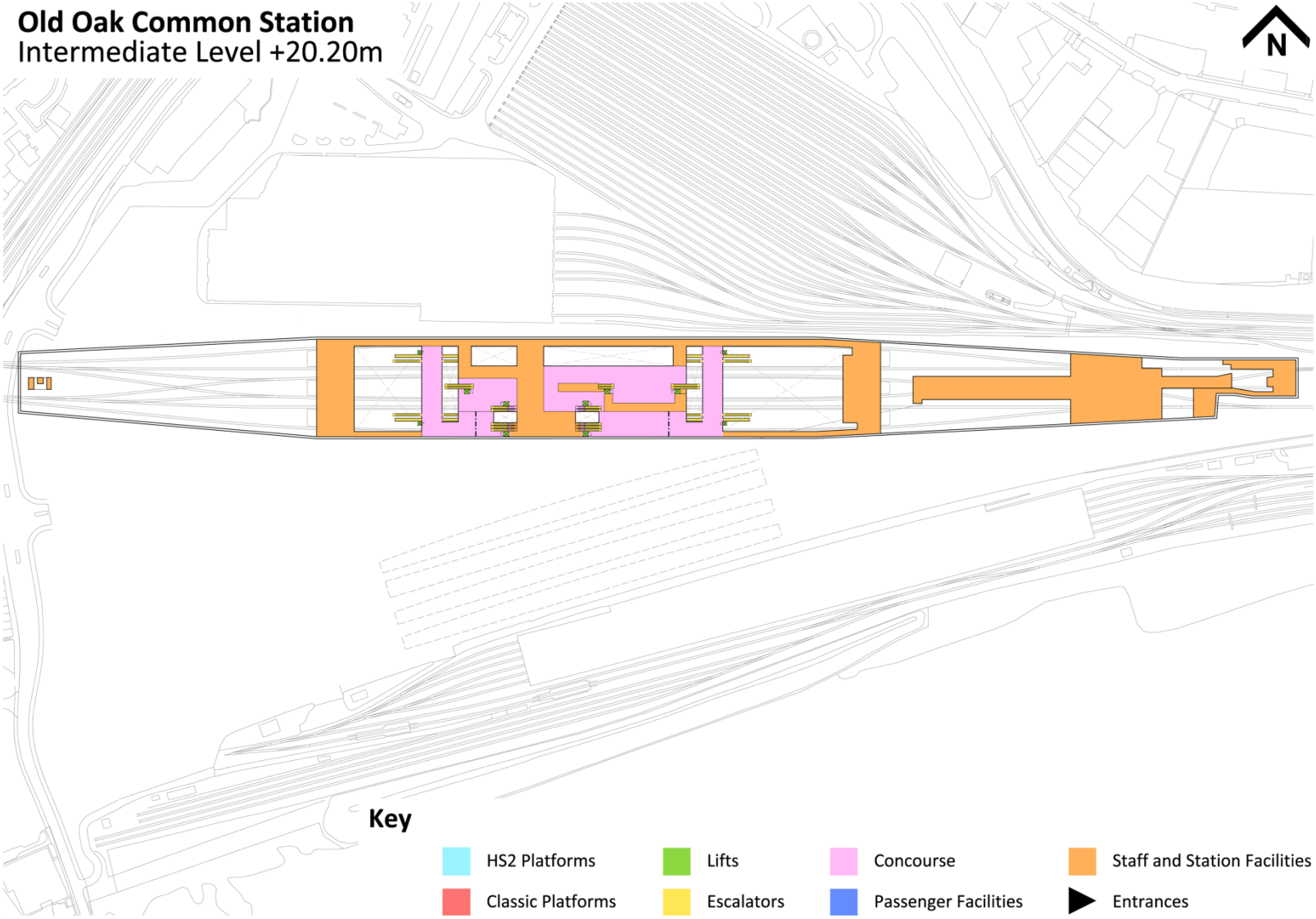


Figure 6: Old Oak Common station block plan: ground level

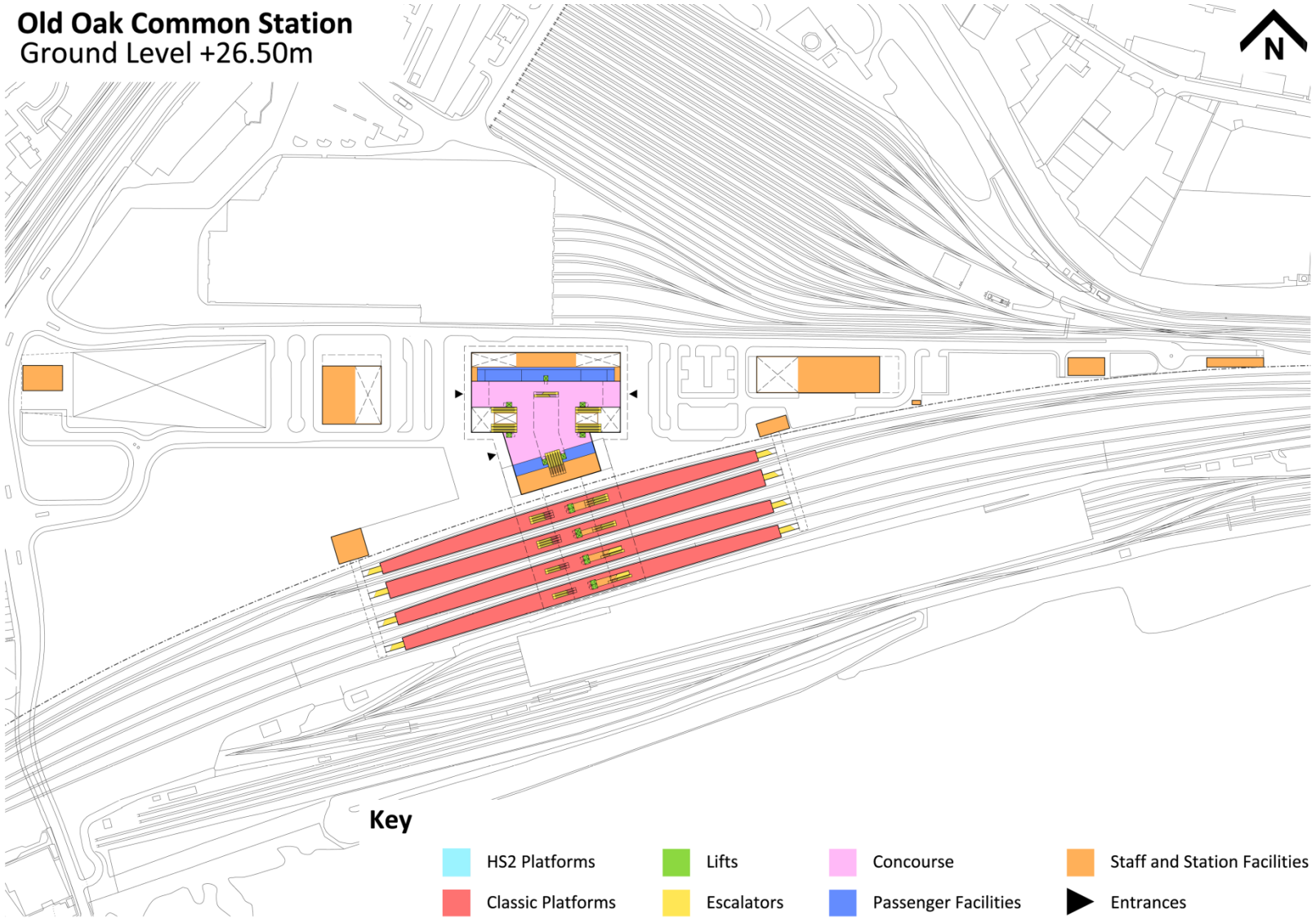
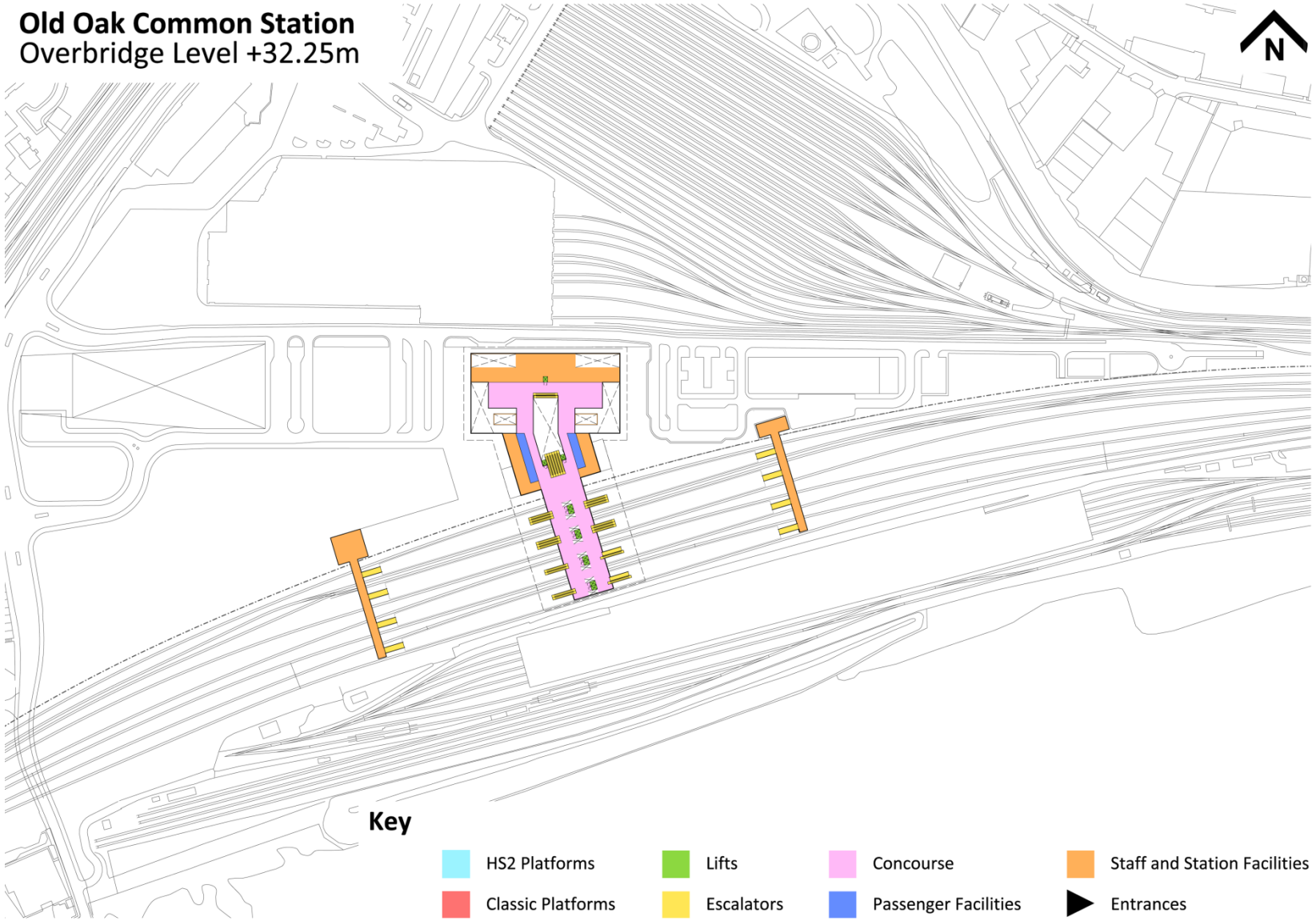


Figure 7: Old Oak Common station block plan: bridge level

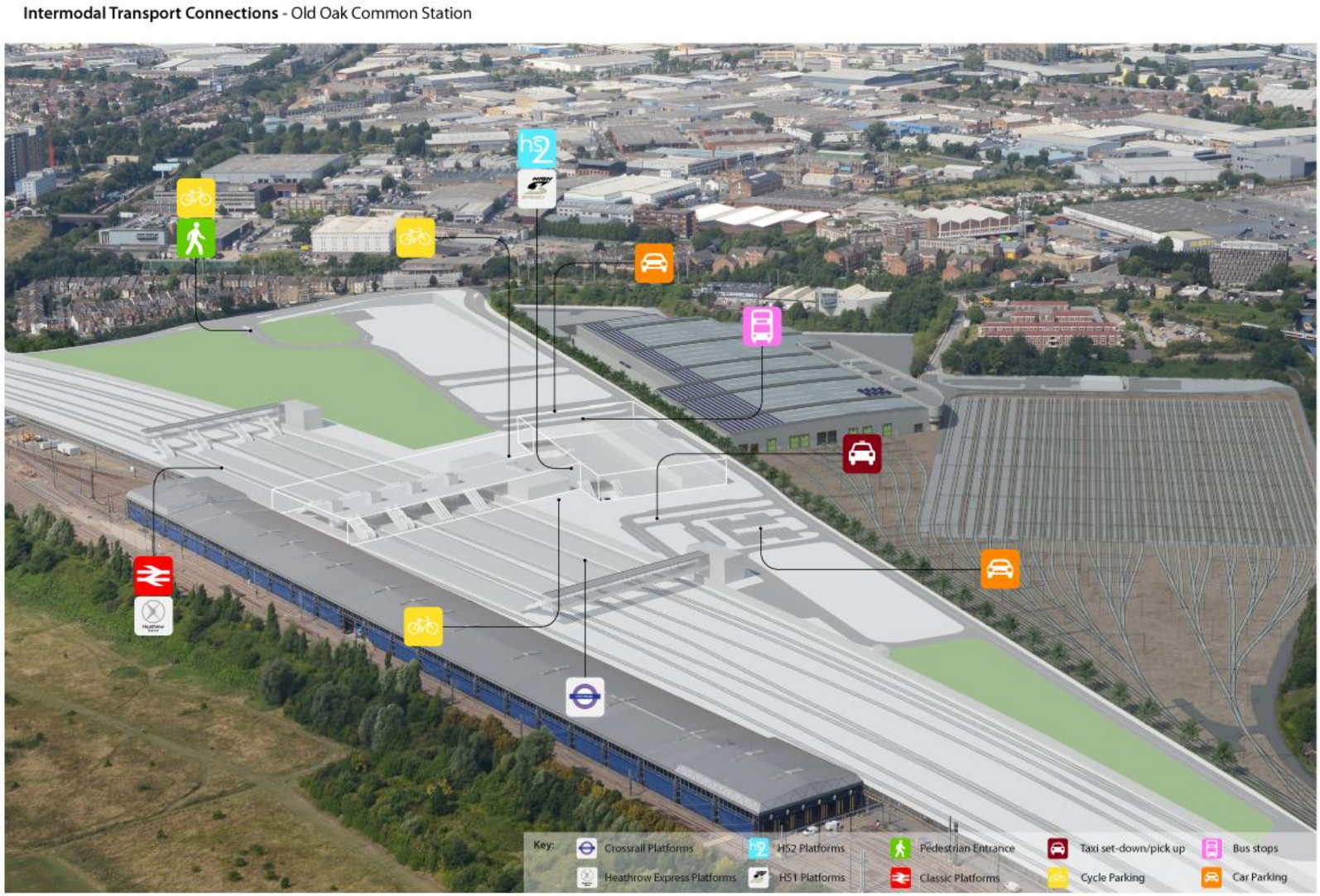


2.3.23 There will be no long-term public parking provisions at Old Oak Common station. Staff parking and short term parking will be provided at the east of the station with bus stands to the west.

2.3.24 Access to Old Oak Common station will be from entrances on Old Oak Common Lane to the west. Traffic will access and exit the station at two points; north-west of the station and to the south of the station, close to the site access to the existing rail depots. Internal roads will provide access for buses, taxis, cars dropping-off passengers and emergency vehicles. They will also connect to the staff and short-term parking areas.

2.3.25 Figure 8 illustrates the HS2 connections at Old Oak Common station with other transport modes.

Figure 8: Old Oak Common station: intermodal transport connections



2.3.26 To enable better access during the construction and operation of Old Oak Common station, alterations to the existing highway network and new highway provisions will be required as follows (as shown on Map CT-06-009a (Volume 2, CFA4 Map Book):

- construction of retaining walls to accommodate widening of and improvements to Old Oak Common Lane;
- lowering of Old Oak Common Lane under the GWML bridges, in order to provide improved headroom and enable access for double-decker buses via Old Oak Common Lane south of the station;
- a new NR substation and access road on land to the south of Wells House Road, west of Old Oak Common Lane and north of the GWML;
- widening and improvements to the A4000 Victoria Road to provide four traffic lanes from the junction of Old Oak Common Lane/Old Oak Lane/Atlas Road southwards to Wales Farm Road at Gypsy Corner junction;
- construction of new boundary retaining walls along the A4000 Victoria Road as shown on Map CT-06-009a (Volume 2, CFA4 Map Book);
- extending the existing bridge on the A4000 Victoria Road above the London Underground Central line to provide a pedestrian footway;
- construction of new pedestrian subways and associated retaining walls on either side of the A4000 Victoria Road under the Cricklewood to Acton Wells Line; and
- modifications to junctions on Old Oak Common Lane and the A4000 Victoria Road with adjoining roads, private accesses and frontages to take into account the widened roads and changes in levels at the boundaries of the road improvements.

2.3.27 To facilitate the construction and operation of GWML Old Oak Common station, alterations to the existing railway network infrastructure and new infrastructure provisions will be required as follows:

- construction of new GWML bridge over Old Oak Common Lane and London Underground Central line north of existing rail crossing;
- reconstruction of existing GWML bridge over Old Oak Common Lane and London Underground Central line as shown on Map CT-06-009a (Volume 2, CFA4 Map Book); and
- realignment of GWML tracks into the new Old Oak Common station.

2.3.28 Landscaping will be undertaken within Old Oak Common station site along the eastern verge of Old Oak Common Lane.

2.3.29 The footpath and steps between Wells House Road and Old Oak Common Lane will be realigned.

2.3.30 Two underground attenuation tanks for rail and station drainage will be located within the Old Oak Common station site.

2.3.31 Works to the following utilities will be required:

- permanent diversion of Thames Water combined sewer located within the Old Oak Common station site, approximately 30m to the east for a length of approximately 200m;
- permanent diversion of existing 6.6kV NR ring main and associated substation located within the Old Oak Common station site;
- permanent decommissioning/removal of two NR transformers to land south of Wells House Road and the ANL tracks; and
- permanent diversion, approximately 45m to the east, for a length of approximately 300m of multiple utilities which currently run along Old Oak Common Lane. Utilities include Thames Water water mains; Thames Water sewer; National Grid gas main; UK Power Network 132kV and five 11kV power cables; BT and Virgin Media fibre optic cables; various telecom network cables and NR high voltage supply.

Old Oak Common tunnel and Victoria Road crossover box

2.3.32 A short section of tunnel, known as the Old Oak Common tunnel, will be constructed to link the Victoria Road crossover box and Old Oak Common station. It will be constructed using the mined tunnelling/sprayed concrete lined (SCL) technique (see Volume 1, Section 6 for further details). This tunnel will have an internal diameter of up to 10.7m. The length of the tunnel between the Victoria Road crossover box and Old Oak Common station will be approximately 320m. The depth below ground will vary between approximately 15m at Old Oak Common station to 20m between Victoria Road and Wells House Road.

2.3.33 The Victoria Road crossover box will be located to the west of Old Oak Common station. The purpose of the crossover box is to allow trains to change tracks and reverse in and out of the station. The crossover box will be approximately 240m in length and will be located below ground level. With the exception of the headhouses, the crossover box will not be covered to allow natural ventilation of the tunnels. Key features will include:

- construction of concrete diaphragm walls (42.5m deep) to form the crossover box approximately 240m long and up to 37.5m wide at the each end. The HS2 tracks will be approximately 22m below ground level within the Victoria Road crossover box and adjacent tunnels;
- two headhouses will be constructed above the Victoria Road crossover box to provide maintenance access, and intervention and evacuation in the event of an emergency. The eastern headhouse will be 32m by 28m wide with a height of 5m. The western headhouse will be 27m by 19m wide with a height of 5 m;

- an auto-transformer station will be built adjacent to the crossover box at ground level;
- diversion of Thames Water sewer and water mains; National Grid gas main; diversion of BT cables, cabinets and equipment; and diversion of Scottish and Southern Electric substations and 11kV cables; and
- permanent closure and removal of Bethune Road.

Northolt tunnel

2.3.34 A twin-bore tunnel, known as the Northolt tunnel, will be constructed from the western end of the Victoria Road crossover box. The Northolt tunnel will have an overall length of approximately 13.5km, but only a short section (approximately 350m) is within the Kilburn (Brent) to Old Oak Common area. The Northolt tunnel is described in more detail in the Northolt Corridor area in CFA5 report.

2.4 Construction of the Proposed Scheme

2.4.1 This section sets out the strategy for construction of the Proposed Scheme in the Kilburn (Brent) to Old Oak Common area, including:

- overview of the construction process;
- description of the advance works;
- description of the engineering works to build the railway;
- construction waste and material resources;
- commissioning the railway; and
- indicative construction programme (see Figure 11).

2.4.2 The assessment presented in this Environmental Statement is based on the construction arrangements as described in this section.

2.4.3 In addition to the land that will be required permanently for the Proposed Scheme (see Section 2.2), land will be required on a temporary basis for construction. Key temporary construction features are illustrated on the construction Map Series CT-05 (Volume 2, CFA4 Map Book). Following construction works, land required temporarily will be prepared for its eventual end use, which will include being returned to its pre-construction use wherever appropriate.

2.4.4 A guide to standard construction techniques is provided in Volume 1, Section 6. In instances for which more than one possible construction technique might be possible, this section specifies which technique has been assumed for the purposes of the assessment.

Overview of the construction process

2.4.5 Building and preparing the railway for operation will comprise the following general stages:

- advance works including: site investigations further to those already undertaken; preliminary mitigation works; preliminary enabling works; utility diversions; and highway improvements;
- civil engineering works including: establishment of construction compounds; site preparation and enabling works; main earthworks, tunnelling and structure works;
- railway installation works including: establishment of construction compounds; infrastructure installation; fit-out of stations, tunnels, vent shafts or other buildings; changes to the existing railway network; and
- testing and commissioning of the railway.

2.4.6 General provisions relating to the construction process are set out in more detail in Volume 1, Section 6 and the draft Code of Construction Practice (CoCP) (see Volume 5: Appendix CT-003-000) including:

- the approach to environmental management during construction and the role of the CoCP (draft CoCP, Section 2);
- working hours (draft CoCP, Section 5);
- the management of construction traffic (draft CoCP, Section 14); and
- the handling of construction materials (draft CoCP, Section 15).

Advance works

2.4.7 There are some early works planned to take place in 2016 associated with railway systems and infrastructure. These works do not affect the validity of this assessment with 2017 as a baseline.

2.4.8 General information about advance works can be found in Volume 1, Section 6. The following works, which will commence in advance of the establishment of the construction compounds and main engineering works, will be required in this area:

- further detailed site investigations and surveys for proposed underground works and construction compounds;
- further detailed environmental surveys;
- advance mitigation works including, where appropriate, contamination remediation, temporary habitat creation and translocation, and built heritage survey and investigation;
- site establishment with temporary fence construction; and
- utility diversions.

Engineering works

2.4.9 Construction of the railway in this area will require engineering works along the entire length of the route, and within land adjacent to the route. This will comprise the following broad types of engineering work:

- civil engineering works such as earthworks, station building and headhouse construction and erection of bridges;
- construction of tunnels by TBM operating 24 hours a day, seven days a week from dedicated tunnelling site at the Victoria Road crossover box main compound;
- underground construction works including tunnelling, station box, crossover box, vent shafts and cross passages;
- a small gauge tunnel construction railway forms an essential part of the TBM logistics and support system, supplying the machines with tunnel lining segments and other consumables using rail mounted vehicles. This railway will be twin-tracked to enable two-way traffic and servicing of cross passage construction; and
- railway installation works such as laying tracks, installing power supply and communications equipment. The track will be slab track within this area (see Volume 1, Sections 5 and 6 for further detail).

2.4.10 The construction of the Proposed Scheme will be subdivided into sections, each of which will be managed from compounds. The compounds will act as the main interface between the construction work sites and the public highway, as well as performing other functions as described below. Compounds will either be main compounds or satellite compounds, which are generally smaller. Some compounds will be used for civil engineering works and others for railway installation works, and in some cases for both.

2.4.11 In the Kilburn (Brent) to Old Oak Common area there will be five main compounds and three satellite compounds used during civil engineering works. Railway installation works will utilise five main compounds during civil engineering works.

2.4.12 Figure 9 shows the management relationship for civil engineering works compounds and Figure 10 for the railway installation works compounds. Details about individual compounds are provided in subsequent sections of this report.

General overview of construction compounds

2.4.13 Main compounds will be used for core project management staff (i.e. engineering, planning and construction delivery), and commercial and administrative staff. In general, main compounds will contain:

- space for the storage of bulk materials (bentonite tanks, aggregates, structural steel and steel reinforcement, pre-cast tunnel segments);

- space for the receipt, storage and loading/unloading of excavated materials either onto of off the site;
- an area for the fabrication of temporary works equipment, reinforcement cages, plunge piles, formwork and finished goods;
- welfare facilities and workshops;
- fuel storage;
- plant and equipment storage;
- office space for management staff, limited car parking for staff and site operatives, and welfare facilities; and
- necessary operational parking.

2.4.14 Satellite compounds will be used as a base to manage specific works along a section of the route. They will usually provide office space for limited numbers of staff, local storage for plant and materials, limited car parking for staff and site operatives, and welfare facilities.

2.4.15 Some compounds will also accommodate additional functions such as railheads which will connect with the existing railway network to enable loading and unloading to and from trains delivering material to the HS2 site or removing excavated material.

2.4.16 Further information on the function of compounds, including general provisions for their operation including security fencing, lighting, utilities supply, site drainage and codes of worker behaviour are set out in Volume 1, Section 6, and the draft CoCP, Appendix CT-003-000, Section 5).

2.4.17 Further information on the construction methods and activities described in this section are set out in Volume 1, Section 6.

2.4.18 The Map Series CT-05 (Volume 2, CFA4 Map Book) show the locations of the construction compounds described below.

2.4.19 Activities that will take place at the construction compounds at Old Oak Common station, Willesden Euroterminal, Atlas Road, Victoria Road tunnel drive site and Victoria Road crossover box are described in more detail below. Together, these sites will provide the strategic construction facilities for the HS2 tunnels throughout London. Although separate sites, these construction sites will be integrated in terms of resources, materials and access and will rely on each other to support the wider construction logistics strategy.

2.4.20 The indicative construction programme for works in the Kilburn (Brent) to Old Oak Common area is shown in Figure 11. Some of the works will take place concurrently. Other works cannot take place until others have finished, e.g. the TBM cannot start driving the tunnels until the Old Oak Common station box is partly constructed.

2.4.21 It is programmed that the Old Oak Common station box and Victoria Road crossover box will commence first. This will allow the Old Oak Common tunnel between these two structures to be constructed from two temporary shafts constructed on the eastern side of the A4000 Victoria Road. In parallel, a haul route along the former ANL railway line will be constructed to provide an off highway link between the Old Oak Common main compound and the Victoria Road tunnel drive site main compound. This will allow movement of vehicles between the compounds without using public highways.

2.4.22 The Willesden Euroterminal main compound will provide railway facilities for the import of materials to construct the tunnels and station and will export excavated material from the tunnel and station construction.

2.4.23 The Atlas Road satellite compound will provide facilities for the manufacture of concrete tunnel segments required to construct the tunnels.

2.4.24 To facilitate operations at each of the above construction compounds a network of enclosed aerial conveyors will be installed to link the Atlas Road satellite compound, the Willesden Euroterminal main compound and the Victoria Road tunnel drive main compound, as shown on Map Series CT-05 (Volume 2, CFA4 Map Book). The conveyors will be approximately 3.3m above ground level at the highest point and will allow material to be transported between compounds and reduce construction traffic on the local highway network. The conveyors will cross the Grand Union Canal throughout the construction period. A temporary road bridge will be constructed between the Atlas Road satellite compound and the Willesden Euroterminal main compound to reduce the impact of traffic between the two compounds on Old Oak Lane.

Construction traffic routes

2.4.25 The movement of construction vehicles carrying materials, plant, other equipment and workforce (or moving empty) will take place both within the construction sites and on public roads. There will also be movement of construction plant and materials via the rail network. The construction compounds will provide the interface between the construction works and the public highway or rail network. The likely road routes to access compounds are described in the sections below.

2.4.26 Movements between the Old Oak Common station main compound and the Victoria Road tunnel drive main compound will be on a temporary haul road, using a temporary bridge over Old Oak Common Lane, to the north of the London Underground Central line.

Utility works

2.4.27 Works will be required to protect or divert existing utility infrastructure due to the construction of the Proposed Scheme. Utility works are described under each of the relevant compounds below. In addition, in this area utilities within the Kensal Green

Cemetery will require protection due to ground settlement which may arise from the tunnel construction.

Figure 9: Schematic of construction compounds for civil engineering works

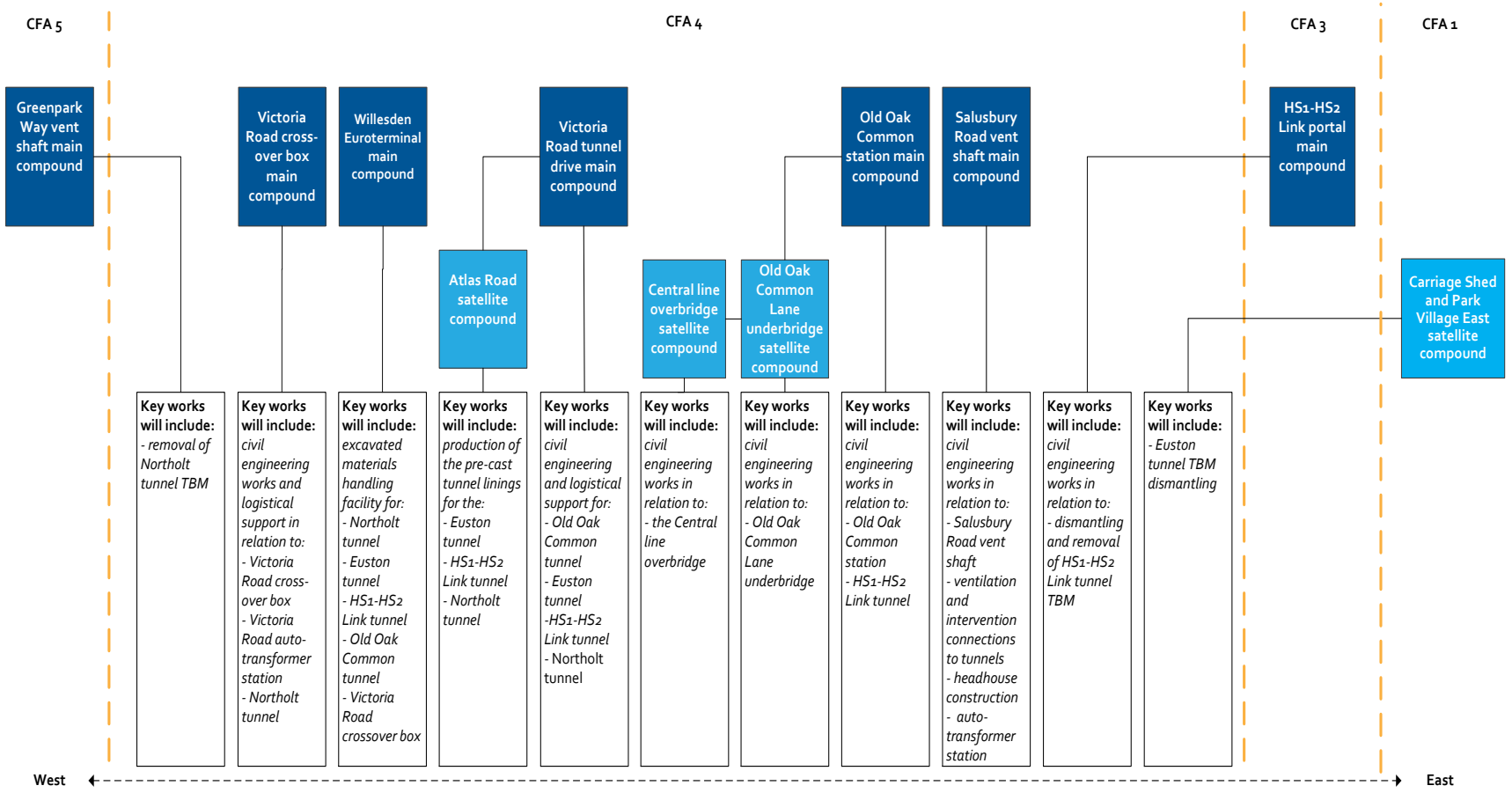
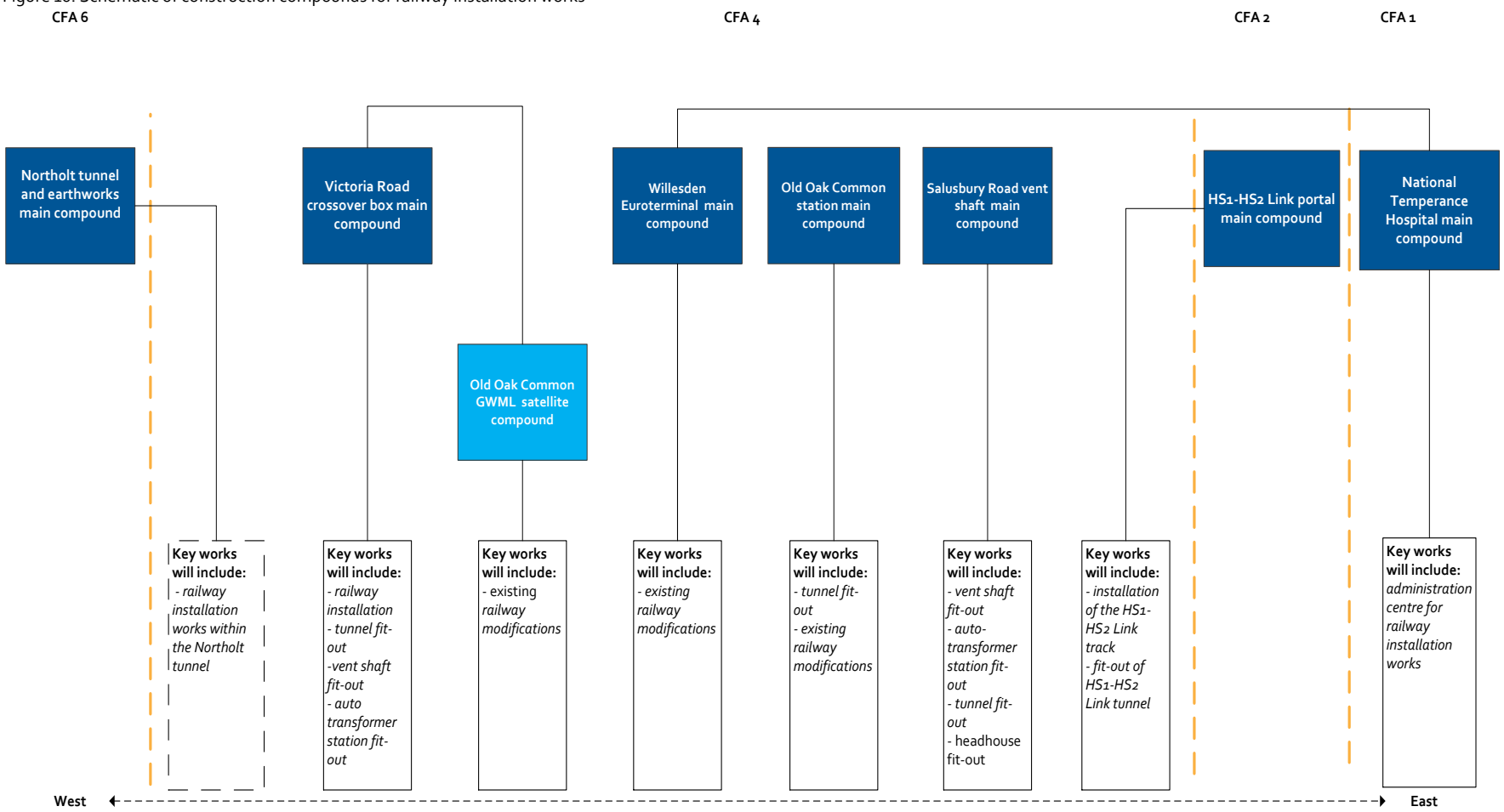


Figure 10: Schematic of construction compounds for railway installation works



National Temperance Hospital main compound

2.4.28 Whilst this compound is located within the Euston area (CFA1) it will provide administrative and site management support for the railway installation works from the Willesden Euroterminal main compound. See CFA1 for further information about this compound.

Carriage shed and Park Village East satellite compound

2.4.29 This compound is located within the Euston area (CFA1). The Euston tunnel between Old Oak Common and Parkway will be bored by two TBM from Old Oak Common. On completing the twin tunnels, the majority of the TBM equipment will be drawn back down the tunnels for recovery at Old Oak Common. At Euston, reception chambers to accommodate the TBM equipment will be constructed using piled walls. It will also be necessary to dismantle some of the TBM equipment to allow it to be drawn back down the tunnels to Old Oak Common. See CFA1 for more information about this compound.

Hs1-Hs2 Link portal main compound

2.4.30 This compound is located within the Camden Town and HS1 Link area (CFA2) and will be the construction compound for the HS1-HS2 Link portal. The compound will also facilitate the removal of the TBM used to construct the HS1-HS2 Link tunnel. It will also be used for railway installation works and tunnel fit-out within the HS1-HS2 Link tunnel. See CFA2 for more information about this compound.

Salusbury Road vent shaft main compound

2.4.31 The compound will be used to manage construction of the Salusbury Road vent shaft including equipment fit-out and will be used for civil engineering and railway installation works and will:

- be occupied for approximately six years and three months but not operational continuously. The excavation and construction of the shaft will take approximately two and a half years, starting in 2018. This will be followed by a two year suspension period. There will then be approximately two and a half years for other civil engineering, mechanical and electrical work with site demobilisation at the end of 2024.
- support approximately 50 workers each day throughout the civil engineering works and support approximately 25 workers each day throughout the railway installation works period;
- facilitate the railway installation works managed from the Victoria Road crossover box main compound; and
- be accessed from the A404 Harrow Road via the B413 Kilburn Lane, or the B414 Salusbury Road and Premier Corner.

2.4.32 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- building demolition;
- vent shaft construction;
- vent shaft internal structures civil engineering and building works;
- excavation and construction of short connecting tunnels between the vent shaft and tunnels;
- headhouse construction;
- railway systems installation;
  - installation of the auto-transformer station at Salusbury Road vent shaft; and
  - fit-out of Salusbury Road vent shaft and headhouse.
- landscaping.

2.4.33 The concrete diaphragm walled earth retained structure construction technique will be used (see Volume 1, Section 6). This will take approximately one year and four months.

2.4.34 Table 1 shows the buildings and structures that will require demolition at the Salusbury Road vent shaft main compound.

Table 1: Buildings requiring demolition at Salusbury Road vent shaft main compound

Description	Location
Commercial property (derelict printer works)	Bounded by Claremont Road and Premier Corner
Commercial property (Premier House - London Underground Limited Bakerloo line welfare facility)	Bounded by Claremont Road, the B413 Kilburn Lane and Premier Corner
Structure (public toilets)	Within public car park adjacent to Premier House
Structure (bus shelter)	On Premier Corner to the west of Premier House

2.4.35 No temporary or permanent diversions of roads, footpaths or cycleways will be required.

2.4.36 No diversions of existing utilities or watercourses will be required.

Old Oak Common station main compound

2.4.37 The compound will be used to manage construction of Old Oak Common station. This compound will be used for civil engineering and railway installation works between Old Oak Common Lane and the A219 Scrubs Lane. The compound will:

- be in place for approximately ten years starting with railway demolition commencing in 2017 followed by civil engineering works. Railway installation works will be undertaken for approximately one year in 2017 and then a further three and half years starting in 2023;
- support approximately 530 workers each day on average throughout the eight year civil engineering works period and support approximately 25 workers each day throughout the railway installation works period;
- facilitate the railway installation works managed from the Victoria Road crossover box main compound; and
- be accessed from the A4000 Victoria Road or the A40 Western Avenue/Westway via Old Oak Common Lane.

2.4.38 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and recovery of existing railway infrastructure in the Old Oak Common station area;
- piling and installation of concrete diaphragm walls to the station box;
- excavation and construction of the eastern and western ends of the station box;
- the formation of the Old Oak Common tunnel portal at the western end of the station box;
- installation of three TBM at the eastern end of the station box to drive the Euston tunnel and HS1-HS2 Link tunnel;
- completion of the central section of the station box and the platforms;
- modifications to the existing GWML railway and bridges;
- construction of Old Oak Common station built over the station box spanning approximately 290m;
- station building works, mechanical and electrical building services, architectural finishes and fit-out of ventilation equipment; and
- finalisation works, including landscaping.

2.4.39 Table 2 shows the buildings and structures that will require demolition to facilitate the construction of Old Oak Common station.

Table 2: Buildings and structures requiring demolition for construction of Old Oak Common station

Description	Location
Commercial property (FGW depot) carriage shed and associated outbuildings and electricity substations	Old Oak Common Lane
Commercial property (HEx depot) carriage shed and associated outbuildings and electricity substations	Old Oak Common Lane

2.4.40 Temporary closure of Old Oak Common Lane will be required for a period of approximately one year to allow for lowering and widening the road beneath the GWML rail bridges (see Section 12 for further detail).

2.4.41 Access to the gardens of approximately 25 properties on the eastern side of Wells House Road will be temporarily required for a period of approximately one year for construction of the Proposed Scheme. The works will involve replacement of the retaining wall that forms the boundary between these properties and Old Oak Common Lane. These works form part of the Old Oak Common Lane widening.

2.4.42 Diversions of five utilities and the installation of one new utility will be required, the key ones being the permanent realignment of:

- National Grid power cables;
- National Grid gas mains;
- Thames Water sewer;
- Thames Water water mains;
- BT telecommunications cables; and
- permanent new power cables, connecting power to the Proposed Scheme at Old Oak Common.

2.4.43 There will be no diversions of watercourses.

2.4.44 An area of Wormwood Scrubs immediately to the north and west of Linford Christie Stadium has been identified for habitat compensation and currently comprises amenity grassland and areas utilised by sports groups. These works will be managed from this construction compound.

Old Oak Common GWML satellite compound

2.4.45 This compound will be used to manage existing railway modification works only, as part of the GWML works at Old Oak Common. The compound will:

- be operational for approximately four years, starting in 2021;

- support approximately 70 workers each day during the peak periods;
- be used for work required to take place at night, weekends and during bank holidays; and
- be accessed from the A4000 Victoria Road or the A40 Western Avenue/Westway via Old Oak Common Lane.

2.4.46 Key works to the existing railway network in this section of the Proposed Scheme will be:

- site clearance; and
- existing railway modifications.

2.4.47 Demolition of the disused London Underground traction feeder station located on NR land between Wells House Road, WLL and Old Oak Common Lane and two electricity sub-station buildings and outdoor transformers associated with the operation of GWML Lines is required.

2.4.48 There will be no diversions of footpaths, cycleways or watercourses.

Old Oak Common Lane underbridge satellite compound

2.4.49 The compound will be used to manage civil engineering works in relation to Old Oak Common Lane underbridge. The compound will:

- be operational for approximately four and a half years for civil engineering works, starting in 2021;
- support approximately 10 workers each day;
- be accessed from the A4000 Victoria Road or the A40 Western Avenue/Westway via Old Oak Common Lane; and
- be managed from the Old Oak Common station main compound.

2.4.50 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- vegetation clearance on a small section of the north west of Wormwood Scrubs for utilities works;
- construct an access bridge into the former ANL temporary haul road over Old Oak Common Lane. The piled abutment with steel and concrete bridge deck construction technique will be used (see Volume 1, Section 6 for further detail);
- provide replacement electrical substation and demolish the existing electrical substation;
- progressive reconstruction of Old Oak Common Lane bridge and demolition of the existing bridge; and

- landscaping and reinstatement of the site, including Wormwood Scrubs.

2.4.51 A temporary road and footpath closure of Old Oak Common Lane will be required for a period of approximately one year, to allow demolition and reconstruction of the Old Oak Common Lane bridge.

Central line bridge satellite compound

2.4.52 This compound will be used for the demolition and replacement of the London Underground Central line bridge. The compound will:

- be operational for approximately three and a half years for civil engineering works, starting in 2021;
- support approximately 10 workers each day throughout the civil engineering works period; and
- be managed from the Old Oak Common station main construction compound.

2.4.53 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- demolish existing disused bridge;
- construct new bridge over central line; and
- site reinstatement.

2.4.54 No utilities diversions are required.

2.4.55 There will be no diversions of footpaths, cycleways or watercourses.

2.4.56 The piled abutment with steel and concrete bridge deck construction technique will be adopted to construct the bridge (see Volume 1, Section 6 for further details).

Atlas Road satellite compound

2.4.57 This compound will be used for production of the pre-cast tunnel linings for the Euston tunnel, HS1-HS2 Link tunnel and Northolt tunnel. The compound will:

- be operational for approximately three and a half years, starting in 2018;
- support approximately 110 workers per shift throughout the civil engineering works period;
- be accessed from the A4000 Victoria Road via Atlas Road;
- be linked to the Willesden Euroterminal main compound, Victoria Road tunnel drive main compound and Victoria Road crossover box main compound via a conveyor and temporary bridge crossing over the Grand Union Canal; and

- be managed from the Victoria Road tunnel drive main compound.

2.4.58 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- building demolition;
- construction of the pre-cast concrete facility;
- operation of the pre-cast concrete facility including batching facilities and movement and storage of pre-cast concrete segments;
- removal of the pre-cast concrete facility; and
- site reinstatement.

2.4.59 Demolition of buildings and structures will be required as shown in Table 3.

Table 3: Demolitions at Atlas Road satellite construction compound

Description	Location
Commercial property (derelict office building, Nash House)	Old Oak Lane,
Commercial property (London United Park Royal Garage, bus depot and associated buildings)	Atlas Road
Commercial property (Tower Transit bus depot and associated outbuildings)	Atlas Road
Commercial property (Park Royal depot and outbuilding, occupied by Redland for the sale of roofing materials	Atlas Road
Commercial property (Gowing and Pursey skips)	Atlas Road
Commercial property (Atlas House - Units 3, 4 and 5, occupied by Ixxy's Bagels, Levantine and Gourmet Buffet Distribution	Atlas Road
Electricity substation within building currently occupied by Makro	Makro, Atlas Road
Electricity substation (Atlas Road)	To the east of Atlas Road on the northern boundary of Rowan House

2.4.60 Atlas Road will be partially closed to traffic for the duration of the works which are programmed to last three and a half years starting in 2021.

2.4.61 No permanent diversions of roads will be required.

2.4.62 No diversions of footpaths, cycleways or watercourses will be required.

Willesden Euroterminal main compound

2.4.63 This compound will be used for the temporary storage, loading and removal of excavated material by rail. The material will arise from the excavation of the Old Oak Common station box, Victoria Road crossover box and tunnels throughout the London area. The compound will also be used for supplying bulk materials for the tunnelling work throughout London and materials for railway modification works in the Euston area (CFA1) and the Camden and HS1 Link area (CFA2). The compound will:

- be operational for approximately seven and a half years, comprising modifications to the existing sidings and railway for approximately half a year, starting in 2016. Civil engineering works will be carried out over approximately five and a half years, starting in 2017;
- support approximately 30 workers each day throughout the civil engineering works period, and support approximately 50 workers each day throughout the existing railway modification works peak periods;
- be used for existing railway modification work required to take place at night, weekends or during bank holidays;
- facilitate the existing railway modification work managed from National Temperance Hospital main compound in the Euston area (CFA1);
- be accessed from Channel Gate Road via the A4000 Old Oak Lane; and
- be linked to the Atlas Road satellite compound, Victoria Road tunnel drive main compound and Victoria Road crossover box main compound via an aerial conveyor and temporary bridge crossing over the Grand Union Canal.

2.4.64 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and preparation;
- modifications to the existing tracks;
- installation and operation of materials handling plant and facilities and excavated material stockpiling;
- assist existing railway modifications within the Euston area (CFA1) and the Camden Town and HS1 Link area (CFA2). See CFA1 and CFA2 for details on the key existing railway modification work; and
- reinstatement of the tracks and materials handling facilities.

2.4.65 Demolition of two cement silos within the Euroterminal site, operated by Tarmac will be required.

2.4.66 No diversions or installation of new utilities will be required.

2.4.67 No diversions of footpaths, cycleways or watercourses will be required.

Victoria Road crossover box main compound

2.4.68 The compound will be used to manage construction of the Victoria Road crossover box. In addition it will be used for the launch and operation of the TBM for the Northolt tunnel. The Northolt tunnel will be approximately 13.5km long and will take approximately four years to construct. It will also be used to support the railway installation works and fit-out within Euston tunnel, HS1-HS2 Link tunnel and Northolt tunnel. The compound will:

- be operational for approximately nine years, comprising civil engineering works for approximately four years, starting in 2017. Railway installation works will be carried out over approximately five years starting in 2021, followed by testing and commissioning of the railway, starting in 2025;
- support approximately 140 workers each day throughout the civil engineering works period and support approximately 65 workers each day throughout the railway installations works period;
- be accessed from the A4000 Victoria Road, Chase Road and Bethune Road;
- be linked to the Willesden Euroterminal main compound, Victoria Road tunnel drive main compound and Atlas Road satellite compound via a conveyor and temporary bridge crossing over the Grand Union Canal and the A4000 Victoria Road; and
- provide administrative and site management support for the railway installation works in this section of the Proposed Scheme as well as the Primrose Hill to Kilburn (Camden) area (CFA3), the Northolt Corridor area (CFA5) and the South Ruislip to Ickenham area (CFA6).

2.4.69 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- building demolition;
- crossover box constructed using concrete diaphragm walls to form an enclosed earth retaining structure below ground level;
- installation, launch and operation of TBM for the Northolt tunnel;
- removal of excavated material by conveyor from the Euston tunnel and HS1-HS2 Link tunnel via Old Oak Common tunnel;
- construction of two above ground headhouses; and
- railway installation works:

- installation of an auto-transformer station adjacent to the Victoria Road crossover box;
- railway installation works within the Northolt tunnel, the Euston tunnel and the HS1-HS2 Link tunnel; and
- removal of the ANL tracks from Old Oak Common to the boundary with the Northolt Corridor area (CFA5).

2.4.70 The concrete diaphragm wall techniques will be used to retain the earth for the crossover box (see Volume 1, Section 6 for further information). A combination of pre-cast concrete lining and sprayed concrete lining will be used for the bored tunnels. For further information on these tunnel lining techniques, refer to Volume 1, Sections 5 and 6.

2.4.71 Demolition of buildings will be required as shown in Table 4.

Table 4: Demolition required at Victoria Road crossover box main compound

Description	Location
Commercial property (Stobart Estates vacant office block and warehouse incorporating London Car Store)	1-4 Bethune Road,
Commercial property (Warehouse and associated electricity sub-station within the building, occupied by PrintSign Design and Prophire UK incorporating, Set Supermarket, Superhire, Old Times Period Furniture and Prop Hire and Modern Props)	55 Chase Road
Commercial property (Salon Services)	Unit 4, Chase Road Trading Estate, 51 Chase Road
Commercial property (Plumbase)	Unit 3, Chase Road Trading Estate, 51 Chase Road
Commercial property (Patchi Mediterranean Sweets)	12 School Road,
Commercial property (Sweetland)	10 School Road
Commercial property (Al-Jabal Foods Wholesale and Distribution)	Units 1-2, School Road
Commercial property (Kensington and Chelsea College, Park Royal Transition Skills Centre)	Units 7-8 School Road
Commercial property (White Rose Laundries and Dry Cleaning Direct)	Units 5-6 School Road
Europa House Building (containing BarBar Restaurant, Casa Bardotti restaurant and Europa Studios comprising multiple small and medium enterprises)	Victoria Road
Commercial property (Med Food Wholesale)	Unit 9 Bethune Road

Description	Location
Commercial property (Tops Pizza/Tops Supplies)	Unit 11 Bethune Road

2.4.72 Diversions of several utilities will be required, the key ones are diversion of :

- Thames Water water mains;
- Thames Water sewer mains;
- National Grid gas mains;
- BT cables, cabinets and equipment; and
- Scottish and Southern Electric substations and 11kV cables.

2.4.73 Bethune Road will be permanently closed as a through road due to the construction of Victoria Road crossover box. Westbound traffic will be diverted via School Road and St. Leonard's Road, eastbound traffic diverted via St. Leonard's Road and Chandos Street.

2.4.74 No diversions of footpaths or cycleways will be required.

2.4.75 No diversions of watercourses will be required.

Victoria Road tunnel drive main compound

2.4.76 This compound will be used for civil engineering and tunnelling installation works between Old Oak Common Lane and the A4000 Victoria Road and logistical support for construction of the Euston tunnel, HS1-HS2 Link tunnel and Northolt tunnel. The compound will:

- be operational for approximately four and a half years, comprising civil engineering works starting in 2017;
- support approximately 270 workers each day throughout the civil engineering works period; and
- be accessed from the A4000 Victoria Road.

2.4.77 Works in this section will be carried out in the following broad phases:

- site clearance and enabling works;
- be linked to the Willesden Euroterminal main compound, Atlas Road satellite compound and Victoria Road crossover box main compound via a conveyor requiring a series of short railway closures (railway possessions) and temporary bridge crossing over the railway, Grand Union Canal and the A4000 Victoria Road;

- building demolition;
- construct two temporary access shafts;
- construct the Old Oak Common tunnel. The sprayed concrete lining technique will be used in the Old Oak Common tunnel. See Volume 1, Section 6 for further detail on this construction technique;
- provide logistical support to TBM constructing the Euston tunnel, HS1-HS2 Link tunnel and Northolt tunnel including the storage of materials and equipment, operation of gantry cranes 24 hours per day, loading of tunnels linings down the shafts on to construction railways;
- backfill and reinstatement of temporary shafts; and
- site reinstatement.

2.4.78 Demolition of buildings will be required as shown in Table 5.

Table 5: Demolitions required at Victoria Road drive main construction compound

Description	Location
Commercial property (Geo.W.Neale, manufactures of solders and casting alloys)	Victoria Road
Commercial property (Quattro (UK) and associated substation, aggregates supplier)	Regency Street, off Victoria Road
Commercial property (Waitrose distribution warehouse and associated electricity substation)	96 Victoria Road
Commercial property (Braiform garment hanger/supplier/manufacturer)	98 Victoria Road
Commercial property (Westwood Business Centre, multiple small to medium enterprises and associated electricity substation)	Units 2-16, 98 Victoria Road
Rowan House (multiple small to medium enterprises)	9-31 Victoria Road

2.4.79 Access will be required to the electrical substation located beneath the access ramp on the south side of the building which is currently occupied by Boden and Co. This will not require the demolition of the building.

2.4.80 Diversions, protection or removal of existing utilities and the installation of new utilities in or near the A4000 Victoria Road will be required, as follows:

- protection, diversion or removal of Scottish and Southern Energy electric substations;
- protection or diversion of electric cables;

- protection or diversion of the British Telecoms ducts, cabinets and other equipment;
- protection or relocation of O2/Airwave/3/Orange/Network Rail base stations;
- diversion, removal or replacement of Thames Water water mains;
- protection or diversion of Thames Water sewer mains; and
- protection or diversion of the National Grid gas mains.

2.4.81 No permanent diversions of roads will be required. Temporary diversions and lane restrictions will be required during utility diversions and road widening operations along the A4000 Victoria Road.

2.4.82 No diversions of watercourses will be required.

Greenpark Way vent shaft main compound

2.4.83 Whilst this compound is located within the Northolt Corridor area (CFA5) it will provide support for the removal of the TBM used to construct the Northolt tunnel (located partly within CFA4). See CFA5 for more information about this construction compound.

2.4.84 Northolt tunnel and earthworks main compound. This compound is located within the South Ruislip to Ickenham area (CFA6), but will provide support to railway installation works, as illustrated in Figure 10, which provide directly for the construction of the Proposed Scheme throughout CFA4. This will be via the temporary West Ruislip railhead which is in this compound. See CFA6 for more information about this construction compound.

Construction waste and material resources

2.4.85 Forecasts of the amount of construction, demolition and excavation waste (CDEW) and worker accommodation site waste that will be produced during the construction of the Proposed Scheme in the Kilburn (Brent) to Old Oak Common area have been prepared and are presented in Volume 5: Appendix WM-001-000.

2.4.86 The majority of excavated material that will be generated across the Proposed Scheme will be reused as engineering fill material or in the environmental mitigation earthworks of the Proposed Scheme.

2.4.87 Based on the mitigation earthworks design approach adopted for the Proposed Scheme, local excess or shortfall of excavated material within the Kilburn (Brent) to Old Oak Common area will be managed with the aim of contributing to the overall balancing of excavated material on a route-wide basis. This overall balance of excavated material is presented in Volume 3, Section 14.

2.4.88 The quantity of surplus excavated material originating from the Kilburn (Brent) to Old Oak Common area that will require off-site disposal to landfill as excavation waste is shown in Table 6. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for reuse within the Proposed Scheme and which will be taken directly from the Kilburn (Brent) to Old Oak Common area for off-site disposal to either non-hazardous or hazardous landfill. This represents a proportion of the total quantity of surplus excavated material that will require disposal which altogether is reported on a route-wide basis in Volume 3, Section 14.

2.4.89 The quantities of demolition, construction and worker accommodation site waste that will be re-used, recycled and recovered (i.e. diverted from landfill) have been based on the landfill diversion performance of similar projects as follows:

- demolition waste: 90%;
- construction waste: 90%; and
- worker accommodation site waste: 50%.

2.4.90 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 6.

Table 6: Estimated quantity of waste going to off-site disposal

Waste type	Estimated material quantities that will be generated (tonnes)	Estimated quantity of waste for disposal to landfill (tonnes)
Excavation	4,680,977	117,446
Demolition	244,345	24,434
Construction	438,713	43,871
Worker accommodation site	0	0
TOTAL	5,364,035	185,751

2.4.91 The assessment of the likely significant environmental impacts and effects associated with the disposal of CDEW and worker accommodation site waste has been undertaken for the Proposed Scheme as a whole (see Volume 3, Section 4).

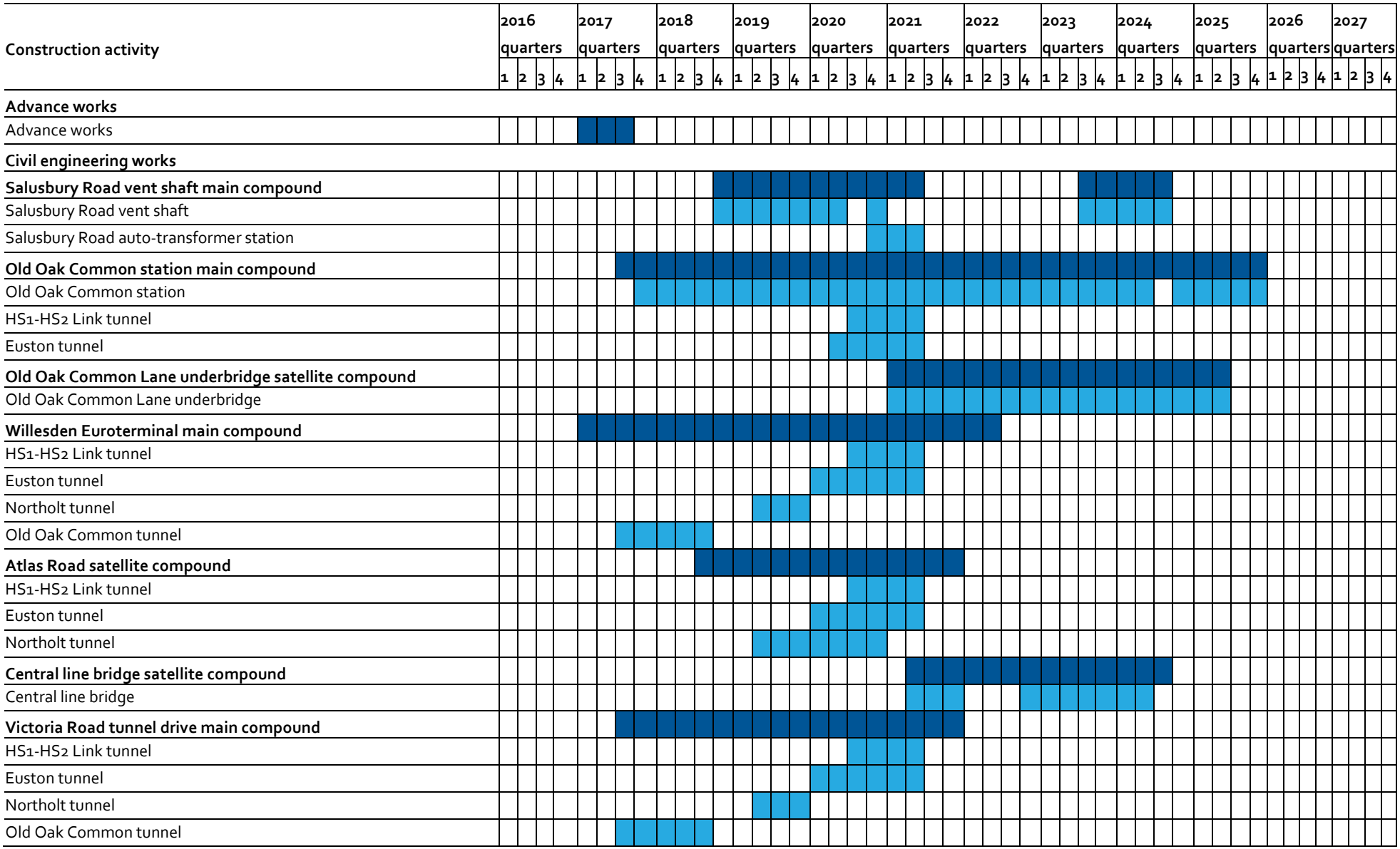
Commissioning of the railway

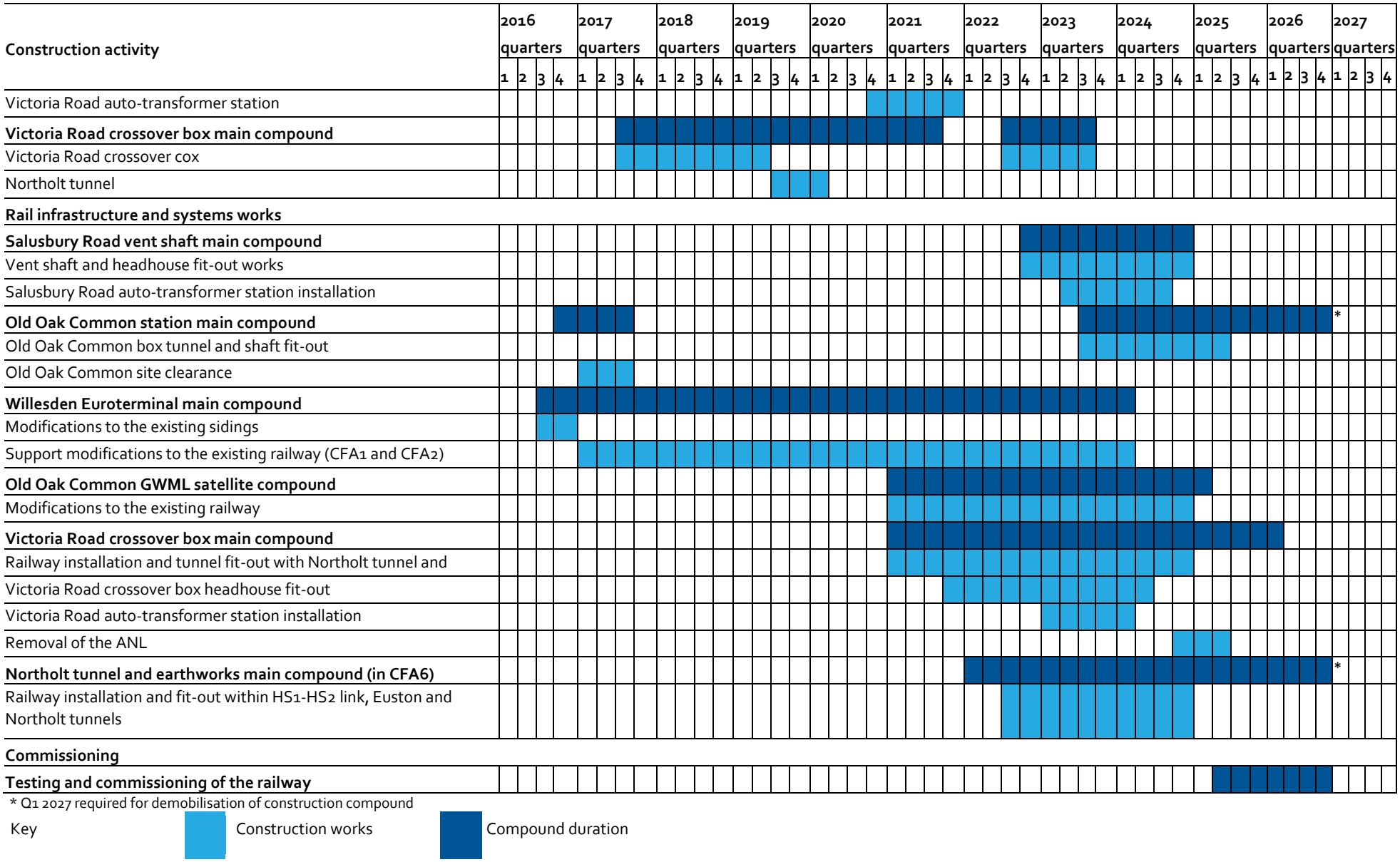
2.4.92 Commissioning is the process of testing the infrastructure to ensure that it operates as expected, and will be carried out in the period prior to opening. Further details are provided in Volume 1, Section 6.

Construction programme

2.4.93 A construction programme that illustrates indicative periods for each core construction activity in this area is provided in Figure 11.

Figure 11: Indicative construction programme




Construction activity
2016 quarters
2017 quarters
2018 quarters
2019 quarters
2020 quarters
2021 quarters
2022 quarters
2023 quarters
2024 quarters
2025 quarters
2026 quarters
2027 quarters
1 2 3 4
Victoria Road auto-transformer station
Victoria Road crossover box main compound
Victoria Road crossover cox
Northolt tunnel
Rail infrastructure and systems works
Salusbury Road vent shaft main compound
Vent shaft and headhouse fit-out works
Salusbury Road auto-transformer station installation
Old Oak Common station main compound
Old Oak Common box tunnel and shaft fit-out
Old Oak Common site clearance
Willesden Euroterminal main compound
Modifications to the existing sidings
Support modifications to the existing railway (CFA1 and CFA2)
Old Oak Common GWML satellite compound
Modifications to the existing railway
Victoria Road crossover box main compound
Railway installation and tunnel fit-out with Northolt tunnel and
Victoria Road crossover box headhouse fit-out
Victoria Road auto-transformer station installation
Removal of the ANL
Northolt tunnel and earthworks main compound (in CFA6)
Railway installation and fit-out within HS1-HS2 link, Euston and Northolt tunnels
Commissioning
Testing and commissioning of the railway
* Q1 2027 required for demobilisation of construction compound
Key
Construction works
Compound duration

2.5 Operation of the Proposed Scheme

Operational specification

2.5.1 Volume 1, Section 4 describes the envisaged operational characteristics of Phase One of HS2 as a whole and how they may change when Phase Two is also operational.

HS2 services

2.5.2 It is anticipated that initially there will be 11 trains per hour each way passing through the Kilburn (Brent) to Old Oak Common area in the morning and evening peak hours, and fewer during other times. The first trains of the day will leave the terminus stations no earlier than 05:00 Monday to Saturday (and 08:00 on Sundays) and the last will arrive no later than midnight.

2.5.3 The frequency of services could rise to 14 trains per hour each way during peak hours, and with Phase Two in place the frequency could rise to 18 trains per hour each way during peak hours. All HS2 trains will stop at Old Oak Common station and will therefore be accelerating away from or decelerating as they approach the station, potentially reaching a maximum of 230kph in tunnels east of the station and a maximum of 320kph in tunnels to the west.

2.5.4 Each train could hold up to 550 people (one-unit train) or 1,100 people (two-unit train). A proportion of the passengers will alight from the trains at the station as their final destination, or alight to transit to other transport services from the station.

Maintenance

2.5.5 Volume 1, Section 4 describes the maintenance regime for HS2.

2.5.6 The intention is that maintenance staff will access the tunnels via the vent shafts to carry out inspections and maintenance on a regular basis. This will be at night when the railway is not operating. There will be routine preventative maintenance, including grinding and milling of the rails to keep them in good condition, and more periodic heavy maintenance as necessary. Should an emergency situation arise, emergency services will use the vent shafts to access the railway below.

Operational waste and material resources

2.5.7 Forecasts of the amount of operational waste that will be produced annually during the operation of the Proposed Scheme have been prepared and are presented in Volume 5: Appendix WM-001-000.

2.5.8 Railway station and train waste refers to waste that will arise at each station. It will include waste from station operations and passenger waste removed from trains at terminating stations. This has only been reported for areas along the route in which these stations will be located.

2.5.9 Rolling stock maintenance waste is that which will be generated by the relevant train operating company at rolling stock maintenance facilities. This has only been reported for the areas along the route in which these facilities will be located.

2.5.10 Track maintenance waste and ancillary infrastructure waste (for example waste from depots, signalling locations, operations and maintenance sites) has been estimated using an average waste generation rate per kilometre length of total track. For this reason, both track maintenance waste and ancillary infrastructure waste has been reported for each area along the route.

2.5.11 The quantity of operational waste that will be re-used, recycled and recovered (i.e. diverted from landfill) has been based on landfill diversion performance information from NR and other sources as follows:

- railway station and trains: 60%;
- rolling stock maintenance: 80%;
- track maintenance: 85%; and
- ancillary infrastructure: 60%.

2.5.12 On this basis, approximately 463 tonnes of operational waste will be re-used, recycled and recovered during each year of operation of the Proposed Scheme in the Kilburn (Brent) to Old Oak Common area. Approximately 260 tonnes will require disposal to landfill (see Table 1: Buildings requiring demolition at Salusbury Road vent shaft main compound Table 7).

Table 7: Operational waste forecast for the Proposed Scheme

Waste source	**Estimated quantity of operational waste per annum (tonnes)**	**Estimated quantity of operational waste for disposal per annum (tonnes)**
Railway station and train	595	238
Rolling stock maintenance	0	0
Track maintenance	118	18
Ancillary infrastructure	10	4
TOTAL	723	260

2.5.13 The assessment of the likely significant environmental effects associated with the disposal of operational waste has been undertaken for the Proposed Scheme as a whole (see Volume 3, Section 14).

2.6 Community forum engagement

2.6.1 HS2 Ltd's approach to engagement on the Proposed Scheme is set out in Volume 1, Section 3.

2.6.2 The engagement undertaken within this community forum area is summarised below. A series of community forum meetings and discussions with individual landowners, organisations and action groups were undertaken. Community forum meetings were held on:

- 21 March 2012 at Hammersmith Town Hall;
- 19 June 2012 at Hammersmith Town Hall;
- 20 September 2012 at Hammersmith Town Hall;
- 21 November 2012 at Hammersmith Town Hall;
- 28 February 2013 at Old Oak Common Community and Children's Centre; and
- 26 September 2013 at the Ramada Encore Hotel.

2.6.3 In addition to HS2 Ltd representatives, attendees at these community forum meetings typically included local residents (and residents groups), public representatives, representatives of the LLB, LBE and CoW, action groups, affected landowners and other interested stakeholders.

2.6.4 The main themes to emerge from these meetings were:

- concerns regarding effects on Wells House Road;
- queries regarding the station at Old Oak Common, including the design of the station;
- queries regarding access to the construction compound at Old Oak Common and concerns about traffic movements (concerns regarding the impact on properties on the A40 Western Avenue;
- concerns regarding tunnelling effects on above ground structures, notably subsidence and noise and vibration, particularly at Wells House Road, North Acton and Kensal Triangle;
- queries regarding the positioning and appearance of the vent shaft at Salusbury Road and LBB Council's planning permission at the proposed site;
- concerns regarding the impact on Kensal Green Cemetery and the multiple listed structures on site;
- concerns regarding road traffic and diversions; and

- concerns regarding the location of access roads to the Old Oak Common station site, in particular why access was not chosen from eastern end of the site.

2.6.5 In addition to the engagement through the community forums, the draft Environmental Statement and Design Refinement consultations were launched on 16 May 2013 and closed on 11 July 2013. As part of these consultations, the public, community groups and other interested parties were notified, provided with information and invited to engage on issues pertinent to the draft Environmental Statement and the development of the Proposed Scheme. Details of the local consultation events were provided on the HS2 Ltd website, social media, posters at local venues, national and regional advertising and to properties within 1km of the Proposed Scheme. In the Kilburn (Brent) to Old Oak Common area, a consultation event on the draft Environmental Statement and on the Design Refinement was held on 15 June 2013 at Old Oak Common Community and Children's Centre.

2.6.6 HS2 Ltd staff attended the event, including engineers and environmental specialists, for members of the public to speak to.

2.6.7 Responses from the draft Environmental Statement consultation have been analysed and an overview of those received and how the Environmental Statement has taken account of responses is contained in the Draft Environmental Statement Consultation Summary Report (Volume 5: Appendix CT-008-000).

2.7 Route section main alternatives

2.7.1 The main strategic alternatives to the Proposed Scheme are presented in Volume 1, Section 10. The main local alternatives considered for the Proposed Scheme within the local area are described in this section.

2.7.2 Since April 2012, as part of the design development process, a series of local alternatives have been reviewed within workshops attended by engineering, planning and environmental specialists. During these workshops, the likely significant environmental effects of each design option have been reviewed. The purpose of these reviews has been to ensure that the Proposed Scheme draws the appropriate balance between engineering requirements, cost and potential environmental impacts.

Salusbury Road vent shaft

2.7.3 The Salusbury Road vent shaft will occupy the western half of a site currently used as a pay and display car park. A diaphragm walling technique will be used to create a shaft covering all three tunnels.

2.7.4 The January 2012 scheme as announced by the Secretary of State comprised a circular vent shaft positioned above the central HS1-HS2 Link tunnel within the site footprint. As part of design development, a number of options for the vent shaft at Salusbury Road were examined:

- Option A: moving the shaft over the northern Euston tunnel to the north-east of the site;
- Option B: moving the tunnel route and shaft headhouse to the north;
- Option C: creating a larger rectangular shaft positioned over all three tunnels below; and
- Option D: moving the shaft entirely away from the site at Salusbury Road to a site at Canterbury Works, a small business park comprising commercial and light industrial activities, approximately 450-500m eastwards.

2.7.5 In engineering terms, Option C was selected for the Proposed Scheme because, despite the additional land required temporarily, the shaft will have a shorter construction time than the other options considered.

2.7.6 The site at Canterbury Works (Option D) was dismissed because of the changes required to the alignment of the tunnel, access issues and likely increased temporary impact on nearby residents and the local school during construction.

2.7.7 In environmental terms, because the duration of impacts on local amenity and local traffic will be reduced for the Proposed Scheme, the extent of noise and air quality effects will also be less.

Great Western Main Line

2.7.8 Works are required to progressively add new tracks and realign the four existing through tracks and create an interchange station facility to be linked to the proposed Old Oak Common station. In the Proposed Scheme the existing GWML will be realigned and doubled in width (Option A). This will allow for the construction of the GWML platforms and concourse bridge, to link to the high speed lines. The station will comprise four GWML platforms using curved platforms and four Crossrail platforms. The platforms in this option will be located at the most southern extent of the Old Oak Common site.

2.7.9 The following seven other options were examined for the works to the GWML at Old Oak Common:

- Option B: the January 2012 announced scheme, with straight platforms located towards the northern end of the Old Oak Common site;

- Option C: the provision of four platforms for Crossrail interchange only - straight platforms located at the most southern extent of the Old Oak Common site;
- Option D: the provision of four platforms for full Crossrail interchange and two platforms with the GWML to allow a partial interchange with additional through GWML. Located at most southern extent of the Old Oak Common site;
- Option E: using the access road on the north side of the existing North Pole depot and future Intercity Express Programme depot. Tracks would be temporarily slewed (moved) to create extra space for the separate construction of the GWML and Crossrail station;
- Option F: GWML and Crossrail station would be constructed in isolation to the existing running lines. This would cause overlap with the HS2 station box due to the restricted site;
- Option G: GWML and Crossrail station located above the HS2 station box. For this study the HS2 station box is assumed not to move; and
- Option H: GWML and Crossrail station located over the HS2 station box which is rotated clockwise to improve GWML main and relief line alignments.

2.7.10 In engineering terms, Option A was chosen because it is offers the highest level of operability. None of the other options considered will provide sufficient levels of operability to meet the requirements of NR and HS2 Ltd.

2.7.11 In environmental terms, Option A was preferred because it will allow a more flexible approach to construction planning, and will reduce the duration of works required in relatively close proximity to the residential area at Wells House Road. Consequently, this will reduce the extent and magnitude of noise and air quality effects during construction for residents in this area.

Station form and design

2.7.12 In the Proposed Scheme, the design for Old Oak Common station comprises two underground levels with a further two levels above ground level (Option A). There will be an interchange between the HS2 services and the services on the GWML and Crossrail.

2.7.13 The following four other options were examined:

- Option B: the January 2012 announced scheme, will provide an arrangement of the station around a central concourse;
- Option C: providing a central station with facilities above ground between HS2 and GWML, with connections above and below ground between the two stations;

- Option D: providing facilities within and above the HS2 box with below ground interchange with the GWML; and
- Option E: facilities for the station provided entirely below ground, with connections between HS2 and GWML platforms also below ground.

2.7.14 Option A was selected on the basis that it will provide an above ground connection between the HS2 services and the services on the GWML. This will deliver a good passenger connection, plus opportunities for further connections to future proposed developments around the station. All of the options would provide an architectural interest and open up the space to the public, transforming the existing depot area. Due to the differences in land levels and the distance from sensitive receptors, each has a similar impact in terms of a townscape aspect. Each option would have a similar impact in terms of land quality (each requiring remediation), air quality, sound and vibration, flood risk and ecology aspects because the amount of development would have been approximately the same, except for the station building's height, compared with the surrounding ground level.

Old Oak Common station east portal ventilation

2.7.15 The January 2012 announced scheme contained a ventilation fan and shaft at the eastern end of the station box. This feature is no longer viable in engineering terms because of other changes to the GWML track alignment needed to travel over the eastern section of the station box. (Option A).

2.7.16 In order to overcome this issue, a number of options for the ventilation equipment were considered, including:

- Option A: the Proposed Scheme, which comprises horizontal ventilation equipment within the tunnels, adjacent to the station box;
- Option B: a vertical ventilation headhouse remote from the station box with air ducted to the tunnels, and an above ground ventilation tower;
- Option C: a vertical ventilation headhouse located on land north of the Grand Union Canal, with underground ducts to each tunnel; and
- Option D: change the ventilation equipment to horizontal fans, located within the tunnels underground, reducing the amount of above ground works required.

2.7.17 Option A was selected on the basis that this will allow for the realignment of the GWML tracks over the eastern section of the station box and the horizontal ventilation equipment will be able to deliver the ventilation required. Reorganising the ventilation equipment to horizontal fans will result in the final structure having a reduced massing in comparison with the original proposal. The other advantage is

that there will be no additional land required for construction on the northern side of the Grand Union Canal.

Old Oak Common station access road

2.7.18 In the Proposed Scheme, operational access to Old Oak Common station will be via two accesses from the widened Old Oak Common Lane. The road will be lowered to allow double decker buses to pass under the GWML bridges and separate bus lanes will be created. In deciding to widen Old Oak Common Lane, the following 13 alternative options were considered:

- Option A: a single access from Old Oak Common Lane, close to the existing HEx and FGW depot entrance;
- Option B: a single access from Old Oak Common Lane sharing the proposed Crossrail depot entrance;
- Option C: a single access from Old Oak Common Lane, north of the existing HEx and FGW depot entrance;
- Option D: a single access from Old Oak Common Lane, south of the existing HEx and FGW depot entrance;
- Option E: a new link road along the ANL railway line - the junction to be level with Old Oak Common Lane;
- Option F: a new link road along the ANL railway line - new bridge over Old Oak Common Lane with direct access into the station site;
- Option G: lowering of the Old Oak Common Lane carriageway bridges;
- Option H: a new tunnelled entrance under GWML from Old Oak Common Lane to the south of the site;
- Option I: an access from the east via Hythe Road;
- Option J: an access from the east via Mitre Way and the North Pole depot;
- Option K: an access from the east via the A219 Scrubs Lane via the 'Big Yellow' Self Storage warehouse;
- Option L: an access from the east via Scrubs Lane through Wormwood Scrubs with bridge over railway lines; and
- Option M: an access from the east via Scrubs Lane through Wormwood Scrubs tunnel under the existing railway lines.

2.7.19 Key environmental issues considered during the option evaluation process included ecology, water and flood risk, community integrity and transport accessibility and

severance[13]. It was considered that the options from the east (Options I to M) were too onerous in terms of cost, difficulty in bridging over the live railway and the impact on Wormwood Scrubs due to land required for construction. The link road via the ANL (Options E and F) was also considered to be onerous in terms of cost, difficulty and impact on residents at Wells House Road. In the Proposed Scheme, access will be provided by a mixture of some of the options, to provide resilience with more than one access from Old Oak Common Lane and to provide sufficient access for increased bus services to the station.

Tunnel lining manufacturing site

2.7.20 In the Proposed Scheme, the pre-cast concrete tunnel linings for the Euston, Northolt and HS1-HS2 Link tunnels will be manufactured at the Atlas Road satellite compound (Option A). This site is adjacent and linked to (by temporary bridges and conveyers) the railhead at the Willesden Euroterminal main compound for receiving material and exporting excavated material, a concrete batching plant to support production of the tunnel segment linings, storage for incoming and outgoing materials, and a lorry holding area.

2.7.21 In choosing this site, the following seven options were examined as alternatives:

- Option B: Hythe Road, an area north of the Grand Union Canal currently occupied by Car Giant;
- Option C: the site known as the Victoria Road tunnel drive main compound, located east of the A4000 Victoria Road; the area currently accommodates several commercial properties including a John Lewis Partnership warehouse, Boden and Co., Westwood business centre, Geo.W.Neale and Quattro (UK);
- Option D: land at Park Royal; north of Park Royal underground station. Cleared industrial land formerly the site of Guinness Brewery, north of the ANL;
- Option E: land at Wormwood Scrubs; an area of open space bounded by HM Prison Wormwood Scrubs and a hospital to the south and the North Pole railway depot to the north;
- Option F: land west of the B4492 Park Royal Road and north of the ANL. The area currently accommodates Sterling Studios, Tarmac Topmix, Suzuya Kosan Co. and Asda;
- Option G: land at Acton Main Goods Yard Site; this area is west to Acton Main Line station with access to site via Horn Lane. The site is currently occupied by recreational land, Yeoman Aggregates and Acton Main Goods Yard; and
- Option H: off-site manufacture of pre-cast concrete tunnel linings.

[13] In the context of traffic, transport and access, severance is used to relate to a change in ease of access for users due to, e.g. a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for users to cross. A reference to severance does not imply a route is closed to access.

2.7.22 In engineering terms, one of the main differences between Option A and other options is the distance between the manufacturing compound and the tunnel drive compounds and the logistics and support required to transport the materials to the compound and the segments from the compound into the tunnels.

2.7.23 The potential for environmental effects was considered when determining suitable site locations. The Car Giant site on Hythe Road (Option B) was discounted because the resulting loss of local employment was considered unacceptable. The Wormwood Scrubs option (Option E) also was considered unacceptable in environmental terms, because it would require the temporary loss of designated Metropolitan Open Land, a local nature reserve used by the local community for recreation.

2.7.24 The other options were considered similar in terms of environmental impact. A shorter distance between the drive site and manufacturing site in Option A is considered preferable because of the reduced potential for traffic and other associated impacts such as the potential for reduced in air quality and increased noise levels. Another factor is the employment density of commercial sites, with business parks generally employing a greater number of people than retail parks. The Victoria Road tunnel drive main compound (Option C) was discounted because of its size and that it was in a better position to be used for the logistics of supporting the tunnel works. The off-site manufacturing option (Option H) did not consider a specific site, but was discounted for its distance from the main tunnelling works and potential for double-handling i.e. moving the segments to the Willesden Euroterminal main compound by rail and then moving by road to the Victoria Road tunnel drive main compound.

Victoria Road crossover box

2.7.25 The Victoria Road crossover box will be located between Chase Road and the A4000 Victoria Road. It is designed to allow trains travelling south towards London to change tracks before entering Old Oak Common station. This requires the tunnels to be joined together to provide enough space for the tracks to do this.

2.7.26 Four options for the crossover box were considered. Three options were considered at Victoria Road which vary in size and shape. A crossover box was also considered at surface level, based on the January 2012 design (before the Northolt tunnel was introduced), located west of the B4492 Park Royal Road, north of North Acton underground station, measuring approximately 600m in length. This surface level option would have required the reconstruction of two bridges

2.7.27 The Proposed Scheme comprises a curved 100kph crossover box located between Chase Road and the A4000 Victoria Road measuring approximately 240m in length, 30m wide and at a depth of 37m. This was chosen because it worked with the option of using the Northolt tunnel and did not require a lengthy temporary closure of the

A4000 Victoria Road. In environmental terms, it will not require the significant diversion of traffic around Victoria Road.

Victoria Road underpass

2.7.28 The widening of the A4000 Victoria Road requires the removal of the pavements either side of the road carriageway. In order to pass under the Cricklewood to Acton Wells Line, two underpasses either side of the road will have to be created under the railway bridge to allow separate safe pedestrian access along the highway.

2.7.29 There were no other options considered for the location of these underpasses. However, the method of construction has been appraised in environmental terms. A number of different ways to construct the underpasses have been considered which include different types of tunnelling under the railway. Each option would require the closure of the Cricklewood to Acton Wells Line and the A4000 Victoria Road for different periods of time.

2.7.30 In environmental terms, each of the options would have similar impacts, both in terms of having to close the A4000 Victoria Road during construction and the additional land required in the Victoria Gardens playground. One of the options considered involved constructing the underpasses off site and sliding them in underneath the railway. This option is likely to reduce the amount of time the road and railway will be closed and is the preferred option in environmental terms.

3 Agriculture, forestry and soils

3.1 Introduction

3.1.1 This environmental topic has been scoped out of the assessment for CFA4 as there are no agricultural or forestry activities affected by the Proposed Scheme in this urban area.

4 Air quality

4.1 Introduction

4.1.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme, covering nitrogen dioxide (NO_2), fine particulate matter (PM10 and PM2.5)[14] and dust.

4.1.2 With regard to air quality, the main potential effects are anticipated to result from the emissions of the above pollutants from road traffic during construction and operation. Dust emissions will be associated with activities including demolition, site preparation works and the use of haul routes within areas of construction.

4.1.3 Detailed reports on the air quality data and assessments for this area, as well as relevant maps are contained within Volume 5. These include:

- Appendix AQ-001-004;
- Map AQ-01-004; and
- Map AQ-02-004-01.

4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2 map books.

4.2 Scope, assumptions and limitations

4.2.1 The assessment scope, key assumptions and limitations for the air quality assessment are set out in Section 8 of Volume 1, the SMR (Appendix CT-001 -000) and the SMR Addendum (Appendix CT-001-000) and appendices presented in Volume 5 (AQ-001-004). This report follows the standard assessment methodology.

4.2.2 The study area for the air quality assessment has been determined on the basis of where impacts on air quality might occur from construction activities, from changes in the nature and volume of traffic during construction and operation or where the road network will change. Changes in road traffic will extend for some distance from the route.

4.2.3 The assessment of impacts arising from construction dust emissions has been undertaken using the methodology produced by the Institute of Air Quality Management (IAQM)[15]. It is important to note that this methodology provides a means of assessing the scale and significance of effects that is partly dependent on the approximate number of receptors within close proximity to the dust-generating

[14] PM2.5 and PM10 describe two size fractions of airborne particles that can be inhaled and therefore are of concern for human health. The designations refer to particles of size less than 10 and 2.5 micrometres in diameter.
[15] Institute of Air Quality Management (2012), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance*.

activities. In doing so, it assigns a lower scale of effect to cases where the number of properties is small, e.g. fewer than 10 within 20m of dust-generating activities. Thus, a single property very close to a construction site cannot experience a 'significant effect' as defined by this methodology. The assessment presented here reaches a conclusion that incorporates this concept of significance being dependent on the number of people affected. However, in cases where fewer than 10 properties are within 20m of the construction activity, it will still be the case that mitigation in accordance with the CoCP will be applied.

4.2.4 The assessment of construction traffic impacts has used traffic data that is based on an estimate of the average daily flows in the peak month throughout the construction period (2017-2026). However, the assessment assumes 2017 vehicle emission rates and 2017 background pollutant concentrations. The reason for this is because both pollutant emissions from exhausts and background pollutant concentrations are expected to reduce year by year as a result of vehicle emission controls, and so the year 2017 represents the worst case for the assessment. Furthermore, it has been assumed that the changes in construction traffic will occur for the whole year. In many cases, this represents a pessimistic assumption as the duration of the proposed construction works may be much shorter.

4.3 Environmental baseline

Existing baseline

4.3.1 The environmental baseline reported in this section represents the environmental conditions identified within the study area. The main source of existing air pollution in the area is emissions from road traffic, as is the case for nearly all parts of London. Concentrations of road traffic-related pollutants are highest in central London. At places very close to roads where traffic flows are high, the airborne concentrations of the main pollutants are elevated substantially when compared to the 'urban background', as exemplified by locations near the A40 Western Avenue.

4.3.2 Estimates for NO2, PM10 and PM2.5 concentrations have been obtained from London-wide modelled pollution maps for 2011[16], published by the GLA in 2010[17]. The 2011 maps have been used to characterise the baseline air quality in London, in addition to monitoring data and the background concentration maps produced nationally by the Department for Environment, Food and Rural Affairs (Defra) that have been used in the assessment on other parts of the Proposed Scheme outside London[18]. The GLA maps reflect concentrations at all locations, including at the roadside, whereas Defra national maps are background concentrations and do not

[16] The 2011 maps are based on projections from a base year of 2008.
[17] Greater London Authority (2010), *Investigation London Atmospheric Emissions Inventory 2008 Concentration Maps*; http://data.london.gov.uk/laei-2008-concentration-maps; Accessed: July 2013.
[18] Department for Environment, Food and Rural Affairs (Defra) (2010), Based Background Maps for NOx, NO2, PM10 and PM2.5; http://laqm.defra.gov.uk/maps/maps2010.html; Accessed July 2013.

include the effects of individual roads. It is therefore considered that the GLA maps provide a more accurate spatial indication of baseline conditions at a local level, although they do not provide projections beyond 2015.

4.3.3 The Old Oak Common area lies within CoW, LBB, RBKC, LBHF and LBE. Within these five boroughs there are 20 automatic air quality monitoring stations. The most directly representative, for reasons of proximity and monitoring site type, is the one at John Keble C. of E. Primary School in LBB. In addition, there are approximately 200 diffusion tube sites measuring concentrations of NO_2 in the five boroughs.

4.3.4 Data collected by the local authorities show that some areas of the Study area currently experience long-term and short-term average concentrations[19] of NO_2 that are above air quality standards, especially in close proximity to major roads. Air quality standards for PM2.5 and PM10 are met in most parts of the study area, but monitoring and mapping data indicate that concentrations are in excess of air quality standards at some major roadside locations. Further details regarding air quality monitoring are shown in Tables 1-4 of Volume 5: Appendix AQ-001-004.

4.3.5 Air Quality Management Areas (AQMA) have been designated for the whole boroughs of the CoW, the LBHF and the LBE, as a result of NO_2 concentrations being in excess of the annual average air quality standard (40µg/m^3) as shown in Map AQ-01-004 (Volume 5, Air Quality Map Book).

4.3.6 There are many receptors in the study area, given its urban nature and the proximity of numerous residential properties and commercial premises to construction sites and roads where traffic flows will change (see Maps AQ-01-004 and AQ-02-004-01 (Volume 5, Map Book Air Quality)). In particular, high densities of housing are located within 20m to the east of the land required for construction on Stephenson Street. Two communities, at Wells House Road and Midland Terrace, are partially encircled by construction compounds. That is, the Old Oak Common station main compound, the Old Oak Common Lane underbridge satellite compound and the Victoria Road tunnel drive main compound.

4.3.7 There are no ecological receptors with national or European level designations, although Wormwood Scrubs Local Nature Reserve (LNR), is just south of the Old Oak Common station main compound.

Future baseline

4.3.8 Volume 5: Appendix CT-004-000 identifies developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the future baseline

[19] Long-term concentrations are usually described by the annual average concentration. Short-term concentrations refer to those which are measured as daily or hourly averages and for which standards refer to peak concentrations.

for the assessment of effects from the construction and operation of the Proposed Scheme.

4.3.9 The data used for the air quality assessment take account of predicted changes in traffic, which are derived from a combination of regional traffic growth factors and consideration of major locally consented schemes, as described in Section 11 (Traffic and transport). In this way, the assessment accounts for cumulative effects

Construction (2017)

4.3.10 Future background pollutant concentrations have been sourced from Defra background maps for 2017 which predict NO2 and PM10 concentrations in 2017 to be lower than in the 2012 baseline.

Operation (2026)

4.3.11 Future background pollutant concentrations have been sourced from Defra background maps for 2026 which predict NO2 and PM10 concentrations in 2026 to be lower than in the 2012 baseline.

4.4 Effects arising during construction

4.4.1 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the CoCP, where appropriate. The draft CoCP will include a range of mitigation measures that are accepted by the IAQM as being suitable to reduce impacts to as low a level as reasonably practicable. It also makes provision for the preparation of local environmental management plans (LEMP). The LEMP will set out how the Proposed Scheme will adapt and deliver the required environmental and community protection measures within each area. This will be through the implementation of specific measures required to control dust and other emissions from activities in the area.

4.4.2 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP (Volume 5: Appendix CT-003-000) will be implemented. These include:

- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;
- inspection and visual monitoring after engagement with the local authorities to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
- cleaning (including watering) of haul routes and designated vehicle waiting areas to suppress dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable and also taking into account the prevailing wind direction relative to sensitive receptors;
- using enclosures to contain dust emitted from construction activities; and

- undertaking soil spreading, seeding and planting of completed earthworks as soon as reasonably practicable following the completion of earthworks.

Assessment of impacts and effects

Temporary effects

4.4.3 Impacts from the construction of the Proposed Scheme could arise from dust-generating activities and emissions from construction traffic. As such, the assessment of construction impacts has been undertaken for human receptors sensitive to dust and exposure to NO2 and PM10, as well as the ecological receptors sensitive to dust.

4.4.4 An assessment of construction traffic emissions has also been undertaken for two sets of scenarios in the construction period: a without the Proposed Scheme scenario and a with the Proposed Scheme scenario. The traffic data include the additional traffic from future committed developments.

4.4.5 In the Old Oak Common area, dust-generating activities will occur at the Salusbury Road vent shaft main compound, and construction compounds at Old Oak Common, Willesden Euroterminal and Atlas Road, and Victoria Road. Dust emissions are most likely to be associated with demolition, site preparation works, construction of the vent shaft, the use of the conveyor to remove material, the use of haul routes within the compounds and the movement of excavated materials by vehicles leaving the construction sites, with the potential for transfer of dust or mud onto local roads.

4.4.6 The use of railheads for moving excavated materials will mean that fewer HGV movements will be required. This will reduce air quality impacts associated with road construction traffic.

4.4.7 With the implementation of mitigation measures contained within the draft CoCP, including the use of LEMP in places where receptors are very close to sources of dust, the assessment of impacts arising from dust emissions has concluded that the air quality impacts will be slight adverse or negligible in magnitude at all receptors and that the effect will not be significant. The basis for this conclusion can be found in Volume 5: Appendix AQ-001-004, which describes the scale of emissions and the proximity of receptors.

4.4.8 Construction activity could also affect local air quality through the additional traffic generated on local roads as a result of construction traffic routes and changes to traffic patterns arising from temporary road diversions.

4.4.9 Examination of the changes in traffic flows during the construction period has identified several roads which will meet the criteria for air quality assessment. Potential traffic impacts have been determined for two scenarios:

- for one period in late 2017/early 2018, taking into account the major movement of excavated material by road, with Old Oak Common Lane open, but without the Willesden railhead open; and

- for a second period in 2023/2024, with the major movement of excavated material by road still assumed to be taking place, with Old Oak Common Lane closed, and with Willesden railhead open.

4.4.10 This assessment presents the most significant impact at each receptor identified from both traffic scenarios. It predicts that there will be substantial adverse impacts on NO_2 concentrations on Shaftesbury Gardens and Victoria Terrace, Victoria Road. It predicts that there will be moderate adverse impacts on NO_2 concentrations on the A4000 Old Oak Lane, Wales Farm Road, and Shaftesbury Gardens due to activity around the Old Oak Common station area. These impacts will result in a temporary significant effect for these receptors. The assessment also found slight adverse impacts for NO_2 concentrations on A4000 Victoria Road (near the A40 Western Avenue) and along the A219 Wood Lane in the vicinity of Burlington Danes Academy. These impacts will not result in significant effects for receptors.

4.4.11 In the south-eastern part of the study area, associated with the movement of excavated material from Euston (in CFA1), temporary moderate adverse impacts on roadside NO_2 are predicted on the A5 Edgware Road between the A40 Marylebone Flyover and Blomfield Road. These are significant effects. A full description of this assessment can be found in Volume 5: Appendix AQ-001-004.

4.4.12 The majority of excavated material will also leave the Willesden Euroterminal main compound by rail. There will be seven such movements per day with diesel powered locomotives emitting NOx. With residential properties within 30m of the railway line, the impact on these emissions on local air quality at these receptors has been assessed and found to be slight adverse. The effect of this is not significant.

Permanent effects

4.4.13 There are no permanent effects anticipated to arise during construction of the Proposed Scheme.

Cumulative effects

4.4.14 The traffic data used for the assessment include the traffic changes expected from the committed developments and therefore their impacts have been included within the assessment.

Other mitigation measures

4.4.15 No other mitigation measures are proposed during construction, in relation to air quality in this area.

Summary of likely significant residual effects

4.4.16 The methods outlined within the draft CoCP to control and manage potential air quality effects from dust emissions at areas of construction activity are considered effective in this section of the Proposed Scheme and no significant residual effects from this source are considered likely. The construction traffic will give rise to

significant adverse residual air quality effects for receptors along a small number of roads. These effects will be of limited duration and occur during periods of peak traffic movements during the construction phase.

4.5 Effects arising from operation

Avoidance and mitigation measures

4.5.1 No mitigation measures are considered reasonably practicable in relation to air quality in the Kilburn (Brent) to Old Oak Common area.

Assessment of impacts and effects

4.5.2 Impacts from the operation of the Proposed Scheme will relate to changes in the volume, composition and distribution of road traffic. There will be no direct atmospheric emissions from the operation of trains that will cause an impact on air quality and these have therefore not been assessed. Tunnel sections have vent shafts to dissipate air pressure waves caused by trains. In normal operations there will be no pollutant emissions from vent shafts as there are no air pollutants emitted within the tunnels and indirect emissions from sources such as rail wear and brakes have been assumed to be negligible.

4.5.3 The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2026: a without the Proposed Scheme scenario and a with the Proposed Scheme scenario.

4.5.4 Traffic data in the Old Oak Common area have been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026.

4.5.5 Some roads are predicted to have sufficiently large changes in traffic flows to meet these criteria for a more detailed assessment. This assessment identified that there will be moderate adverse impacts for fewer than 20 properties assessed for NO_2 along the A4000 Old Oak Lane between the junctions with Channel Gate Road and Atlas Road. This is caused by the small increase in concentrations taking the total concentration above the standard of 40µg/m^3. These impacts are significant for receptors. Further details regarding this assessment are provided in Volume 5: Appendix AQ-001-004.

Other mitigation measures

4.5.6 No other mitigation measures are proposed in relation to air quality in this area during operation.

Summary of likely significant residual effects

4.5.7 Once the Proposed Scheme is in operation, changes in traffic are anticipated to be the cause of significant residual effects for air quality at a small number of residences next to a short section of the A4000 Old Oak Lane. Whilst these effects are residual, they

should be seen in the context of future improvements in background air quality brought about by continued reductions in vehicle emissions, which are expected to reduce NO2 concentrations still further beyond 2026.

5 Community

5.1 Introduction

5.1.1 This section reports the impacts and likely significant effects on local communities resulting from the construction and operation of the Proposed Scheme.

5.1.2 Key issues concerning the community assessment for this study area comprise:

- loss of the public toilets in the car park adjacent to Premier House, Salusbury Road;
- impacts on amenity of residents in properties on the B414 Salusbury Road, Claremont Road and east of the B413 Kilburn Lane during construction;
- impacts on isolation and amenity of the residents of Wells House Road during construction;
- impacts on amenity of residents in properties on Midland Terrace, Shaftsbury Gardens and Old Oak Common Lane during construction; and
- temporary and permanent loss of access to open space at Victoria Gardens and Cerebos Gardens during construction and operation.

5.1.3 Further details of the community assessments and write-ups of open space and recreational PRoW surveys undertaken within the CFA are contained in Volume 5: Appendix CM-001-004.

5.1.4 Significantly affected community resources are shown on Maps CM-01-009b to CM-01-012-R1 (Volume 5, Community Map Book).

5.1.5 The current assessment draws upon information gathered from local and regional sources including Wells House Road residents and engagement with local authorities in the study area.

5.2 Scope, assumptions and limitations

5.2.1 The assessment scope, key assumptions and limitations for the community assessment are set out in Section 8 of Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

5.3 Environmental baseline

Existing baseline

5.3.1 Baseline data on community resources was collected up to 500m from the centre line of the route and, additionally, up to 250m from the boundary of land required for construction.

5.3.2 The study area includes the area of land required both temporarily and permanently for the construction and operation of the Proposed Scheme, together with a wider corridor within which receptors or resources could be affected by a combination of significant residual effects, such as noise, vibration, construction dust, poor air quality and visual intrusion. In addition, the study area has regard to the proposed routeing of construction traffic and takes account of catchment areas for community facilities which could be affected where crossed by the Proposed Scheme.

5.3.3 This area includes land surrounding Salusbury Road and the Old Oak Common area. These areas are focused on the main concentrations of construction activity. Elsewhere in the study area, the route is in tunnel, and therefore there are not likely to be any significant effects on community resources.

5.3.4 Generally, the area is urban with a high density of residential dwellings in the east within Kilburn, Kensal Rise, West Kilburn and Kensal Green. To the south of Kensal Green, its character changes with the presence of Kensal Green Cemetery, the Grand Union Canal and Wormwood Scrubs. West of these open spaces the area is dominated by railway depots and sidings and industrial warehouses at Old Oak Common and North Acton bounded by housing estates in East Acton to the south.

Salusbury Road

5.3.5 The land required for the construction and operation of the Proposed Scheme at the Salusbury Road vent shaft includes a car park off Premier Corner located to the north of Queen's Park housing estate at the junction of the B414 Salusbury Road and the B413 Kilburn Lane. Within the car park are public toilets. There are residential properties on the B414 Salusbury Road, Claremont Road and the B413 Kilburn Lane in close proximity to the car park. St. Luke's Church on Fernhead Road, fronts onto the B413 Kilburn Lane.

5.3.6 The main local services on the B414 Salusbury Road are a post office, Kilburn Public Library and Kilburn Police Station. In addition, to the south of the B414 Salusbury Road is Queen's Park Estate Office on Bruckner Street, which provides housing support for the Queen's Park Estate. The Blessing Medical Centre is situated on the corner of the B413 Kilburn Lane and Claremont Road.

Old Oak Common area

5.3.7 The area around the proposed Old Oak Common station is bounded to the north and south by railway depot sites, to the west by the A4000 Old Oak Common Lane and to the east by the A219 Scrubs Lane bridge. The immediate surrounding area is dominated by the presence of the depots and extensive railway sidings as well as the Kensington and Chelsea College Transition Skills Centre on Bethany Road. Immediately adjacent to the south western extent of the proposed Old Oak Common station there are 121 residential properties at Wells House Road which are accessible via the A4000 Old Oak Common Lane. There is also a small care home

with four residents with special needs on Wells House Road. Existing railway lines provide the southern border and the A4000 Old Oak Common Lane provides the eastern boundary.

5.3.8 Community facilities in the vicinity of Old Oak Common include: Wormwood Scrubs park and John Perryn Primary School on Long Drive to the south and Kensal Green Cemetery and St. Mary's Catholic Cemetery to the east. To the north-west of Old Oak Common is a small park called Victoria Gardens at the junction of Midland Terrace and the A4000 Victoria Road. There are two areas of open space either side of Midland Terrace with the western part containing a children's play area. To the north-east of Victoria Gardens lies Cerebos Gardens.

5.3.9 To the north of this area, Willesden Euroterminal and Altas Road are in the vicinity of Willesden Junction station. Willesden Junction station is surrounded by a mixture of industrial warehouses, railway depots and sidings and residential dwellings on Harley Road, the A4000 Victoria Road, Old Oak Lane, Goodhall Street, Stephenson Street, Shaftesbury Gardens and the travellers' site on Bashley Road. Community facilities in the area surrounding Willesden Junction include Brent Medical Health Service on Avenue Road; Harlesden Baptist Church and its associated hall on Acton Lane, Harley Gospel Hall on Harley Road and Willesden County Court on Acton Lane.

Future baseline

Construction (2017)

5.3.10 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. The LBB allocation (SK1) and outline planning application (12/0788) identify a mixed use development, including residential, community facilities (including the British Legion premises), retail, open space and a new bus interchange, on the site which is partly required for Salusbury Road vent shaft. Therefore, this development will not be able to be implemented in its entirety.

Operation (2026)

5.3.11 The review of future baseline conditions has not identified any additional committed developments within the study area, which will be completed by the year of operation.

5.4 Effects arising during construction

Avoidance and mitigation measures

5.4.1 The amount of land required to construct the Proposed Scheme has been reduced and the number of residential properties where land is required has also reduced.

5.4.2 The draft CoCP includes a range of provisions that will help mitigate community effects associated with construction within this study area, including:

- appointment of community relations personnel (draft CoCP, Section 5);
- community helpline to handle enquires from the public (draft CoCP, Section 5);
- layout of construction compounds to reduce nuisance (draft CoCP, Section 5);
- where reasonably practicable, maintenance of PRoW for pedestrians and cyclists around the perimeter of construction compounds and across entry and exit points (draft CoCP, Section 5);
- monitoring and management of flood risk and other extreme weather events which may affect community resources during construction (draft CoCP, Sections 5 and 16);
- specific measures in relation to air quality and noise will also serve to reduce potential impacts for the neighbouring communities including discretionary noise insulation for sensitive community resources and, in special circumstances, temporary rehousing (draft CoCP, Sections 7 and 13); and
- where practicable, the avoidance of large goods vehicles operating adjacent to schools during drop off and pick up periods (draft CoCP, Section 14).

Assessment of impacts and effects

5.4.3 Details of all assessments of community resources are included in Volume 5: Appendix CM-001-004. Each assessment form presents information that explains the rationale for determining the rating for sensitivity of the affected community resource, the magnitude of impact and the assessment of significance.

Salusbury Road

Temporary effects

Residential properties

5.4.4 Residents at approximately 80 properties on the B414 Salusbury Road, Claremont Road and some properties at the east of the B413 Kilburn Lane are predicted to experience in-combination effects during construction. These effects are:

- significant visual effects on views west from the B414 Salusbury Road, north from the B413 Kilburn Lane and east from Claremont Road; and
- significant noise effects on residents from vent shaft construction activities.

5.4.5 The combination of these effects, which will coincide for between six months and one and a half years, will have a major adverse effect on residential amenity and is considered significant.

Permanent effects

Community infrastructure

5.4.6 The main construction site for the Salusbury Road vent shaft will require the demolition of public toilets in the car park adjacent to Premier House. The loss of the

public toilets for the duration of the construction works - approximately three years - is considered to be a moderate adverse effect and is therefore significant.

Old Oak Common area

Temporary effects

Residential properties

5.4.7 Wells House Road will be bordered to the west by the Victoria Road crossover box main compound. The Old Oak Common station main compound will lie directly to the east of Old Oak Common Lane. There will be no road or pedestrian access to the south on Old Oak Common Lane during the construction works, so Wells House Road will only be accessible from the north, sharing the road with construction traffic.

5.4.8 Residents of properties on Wells House Road are predicted to experience in-combination effects as a result of construction activity to the east, south and west. The in-combination effects are most likely to affect approximately 100 properties on the outer sides of the triangular area. The effects are:

- significant noise effects from daytime, evening and night-time construction activities at the Old Oak Common station main compound and Victoria Road crossover box main compound; and
- significant visual effects for properties looking east, west and south from Wells House Road towards the Old Oak Common station main compound and the Victoria Road crossover box main compound.

5.4.9 The combination of these effects, which will coincide for approximately five years, will have a major adverse effect on the amenity of residents at Wells House Road, which is considered significant. Section 11 (Sound, noise and vibration) describes the measures to mitigate the effects on residents at Wells House Road.

5.4.10 In addition, there will be a series of impacts on pedestrian and vehicle access including road closures and diversions, as described in Section 12 (Traffic and transport). On Old Oak Common Lane, south of the junction with Wells House Road, the road will be closed for approximately one year. This will mean that the residents of Wells House Road will not be able to access community facilities, including schools, childcare and shops, situated to the south, via Old Oak Common Lane. It will continue to be possible to travel north on Old Oak Common Lane from Wells House Road. The additional construction traffic using this part of Old Oak Common Lane will also mean that residents experience construction activity on a daily basis.

5.4.11 Therefore, the reduced access will result in increased isolation of the Wells House Road community, particularly in relation to accessing community facilities to the south, for a period of approximately one year. This will be a major adverse effect, and is therefore considered to be significant.

5.4.12 During the closure of Old Oak Common Lane, works will be undertaken to the retaining wall at the rear of residential properties on the eastern side of Wells House Road. This retaining wall forms the boundary between these properties and Old Oak Common Lane. Access to the gardens of approximately 25 properties on the eastern side of Wells House Road will be required for a period of approximately one year. The majority of the works will be undertaken from Old Oak Common Lane to reduce impacts on residents, and therefore the temporary requirement for land is not considered to result in a significant effect.

5.4.13 Residents of approximately 65 properties on Shaftesbury Gardens, Midland Terrace and Old Oak Common Lane are predicted to experience in-combination effects during construction. The effects are:

- significant noise effects from daytime construction activities at the Old Oak Common station main construction compound and Victoria Road crossover box construction compound;
- significant visual effects, for properties facing west, from construction works to widen the A4000 Victoria Road; and
- significant increase in HGV traffic on the A4000 Victoria Road which will serve as a route for construction traffic. In addition, during the closure of Old Oak Common Lane, re-routed traffic will also use the A4000 Victoria Road and frequently accessed community facilities are located to the south on Old Oak Common Lane. Access to Shaftesbury Gardens and Midland Terrace is from the A4000 Victoria Road.

5.4.14 The community noise effects are expected to last for approximately two years affecting Shaftsbury Gardens and Midland Terrace and for approximately five years affecting Old Oak Common Lane. The combination of the significant effects will have a major adverse effect on the amenity of residents at these properties, which is considered significant.

5.4.15 There are not predicted to be any significant effects on the travellers' site on Bashley Road.

Public open space and recreational PRoW

5.4.16 There is an existing bridge on the A4000 Victoria Road over the Cricklewood to Acton Wells Line west of the access to Midland Terrace. Two new underpasses will be created, one either side of the vehicular highway, to accommodate dedicated footpaths and a cycleway. The construction of the Victoria Road pedestrian underpass on the south-eastern side of the A4000 Victoria Road and widening of Victoria Road will require land at Victoria Gardens. The gardens comprise two sections separated by Midland Terrace. The western side of the garden contains a children's play area. The eastern side is a grassed area. Both sections of the gardens will be closed for the two-year duration of the construction works.

5.4.17 The limited availability of nearby alternatives means that the temporary loss of the use of Victoria Gardens for a period of two years is considered to be a major adverse effect and is therefore significant. Following construction, approximately 80% of the eastern part and, approximately 70% of the western part of the gardens will be reinstated.

5.4.18 The widening of the A4000 Victoria Road will also require land at Cerebos Gardens, a strip of grass directly north-east of Victoria Gardens. All of Cerebos Gardens will be required during the two year construction period. The area is reasonably well-used by people walking their dogs, as there are limited nearby alternatives. The temporary loss of the use of this land is considered to be a major adverse effect and is significant. The grassed area will be reinstated following the completion of construction activity.

5.4.19 The Grand Union Canal runs through the study area and a towpath and cycleway runs alongside the canal. There is no permanent or temporary re-routeing affecting the canal and no significant effects on the amenity of users are predicted.

5.4.20 Construction works will require access to a small area of land at the northern edge of Wormwood Scrubs park (less than 5%). In addition, a small area near the southern periphery of Wormwood Scrubs will be used for ecological mitigation. This will not affect land used for recreational sports pitches). There are not predicted to be any effects on the amenity of users of Wormwood Scrubs or Little Wormwood Scrubs.

Permanent effects

Community infrastructure

5.4.21 The construction works for the Victoria Road crossover box will result in the demolition of a site used by Kensington and Chelsea College on School Road. This is a Transition Skills Centre, which opened late 2012, and provides training in the skills required for employment in the construction industry.

5.4.22 This site is situated within a predominantly commercial area, with suitable alternative units available nearby. The demolition of this resource is considered to be a moderate adverse effect on the community and is therefore significant.

Public open space and recreational PRoW

5.4.23 A consequence of the temporary requirement for land at Victoria Gardens is that the children's play area within the gardens will be demolished and therefore is permanently lost. The construction of the Victoria Road pedestrian underpass on the south-eastern side of the A4000 Victoria Road and the widening of the road require land permanently. Approximately 20% of the eastern part of the gardens and approximately 30% of the western part of the gardens are required permanently for the widened A4000Victoria Road. The permanent requirement for this land is considered to result in a moderate adverse significant effect on the use of the Victoria Gardens.

5.4.24 In addition to the temporary requirement for land at Cerebos Gardens, the widening of the A4000 Victoria Road requires about 50% of this strip of grassed area permanently. The remaining land is considered sufficient to enable the gardens to be used for dog walking and the reinstated area of Victoria Gardens will also provide access to nearby open space for local residents. Therefore, the permanent requirement for land at Cerebos Gardens is not considered to result in a significant effect.

Cumulative effects

5.4.25 No significant temporary or permanent cumulative effects during construction have been identified.

Other mitigation measures

5.4.26 The reported effects of isolation, land required for construction and amenity affecting the residents in Wells House Road are considered to act together, and the long duration of these effects means that this community is expected to experience a community-wide cumulative effect.

5.4.27 HS2 Ltd is seeking to reach agreements with stakeholders on the measures proposed to mitigate or offset a number of the significant effects arising during construction. These measures are described in the following paragraphs.

5.4.28 HS2 Ltd will work with the LBE to identify a suitable site on which to re-provide the public toilets required as part of the Proposed Scheme on the site of the Salusbury Road vent shaft.

5.4.29 HS2 Ltd will work with the local community and the LBE to review mitigation measures to determine the most effective methods to mitigate the isolation effects affecting residents at Wells House Road. Such measures will be aimed at providing access to community facilities to the south accessed by Old Oak Common Lane.

5.4.30 HS2 Ltd will work with LBE and local residents to identify a suitable area for temporary relocation of the children's play area at Victoria Gardens during the construction period. Following completion of construction activity, HS2 Ltd will reinstate the children's play area.

5.4.31 HS2 Ltd will work with the owners of the Transition Skills Centre to assist them with the identification of suitable alternative premises, to which the affected facility could relocate on the basis that it will be eligible for financial compensation under the National Compensation Code. If alternative premises could be acquired in the same locality for the relocation of this facility this would fully mitigate the effect which would no longer be significant.

Summary of likely significant residual effects

5.4.32 Open space at Victoria Gardens and Cerebos Gardens will be temporarily required during construction of the Proposed Scheme and the temporary loss of the children's play area will result in an effect on the community. The premises of Kensington and Chelsea College at Park Royal will be required permanently.

5.4.33 The public toilets at Premier Corner will be demolished for construction of the Salusbury Road vent shaft. Close to the construction of the Proposed Scheme at the Salusbury Road vent shaft, the amenity of residents in properties on Claremont Road and the B414 Salusbury Road will be affected temporarily.

5.4.34 Residents of Wells House Road are predicted to experience isolation effects as a result of works to construct the Proposed Scheme. Also, the amenity of residents at Wells House Road will be affected temporarily by the construction of the Proposed Scheme. The amenity of residents at Shaftesbury Gardens, Midland Terrace and Old Oak Common Lane will also be temporarily affected.

5.5 Effects arising from operation

Avoidance and mitigation measures

5.5.1 No specific measures have been incorporated into the Proposed Scheme design as part of the design development process to avoid or minimise adverse environmental impacts during operation.

Assessment of impacts and effects

Old Oak Common area

5.5.2 The assessment has not identified any significant adverse effects in any of the relevant topic areas considered arising from the operation of the Proposed Scheme.

5.5.3 There are potential benefits to the existing and future communities expected as a result of the regeneration of the area. The Old Oak Common site is located within the Park Royal Opportunity Area, identified in the Mayor of London's planning framework. The Opportunity Area Planning Framework identifies substantial capacity in the area to accommodate commercial and other development, with the scale of development closely linked to the extent of the transport hub created by Crossrail and HS2 services. Old Oak Common station will provide rapid and convenient access to central London and destinations on the national network. HS2 services from Old Oak Common station will provide additional linkages to the West Midlands as well as mainland Europe. The successful development of the area around this hub could potentially accommodate up to 90,000 jobs, and new retail, leisure and social infrastructure, to serve the station and support both the new and existing local communities.

Other mitigation measures

5.5.4 The above assessment has concluded there are no significant adverse effects arising during operation, therefore no further mitigation is proposed.

Summary of likely significant residual effects

5.5.5 No residual significant effects on the community resulting from operation have been identified in this assessment.

6 Cultural heritage

6.1 Introduction

6.1.1 This section of the report provides a description of the current baseline for heritage assets and reports the likely impacts and significant effects resulting from the construction and operation of the Proposed Scheme. Consideration is given to the extent and heritage value (significance) of assets including archaeological and palaeo-environmental remains; historic buildings and the built environment; and historic landscapes.

6.1.2 With regard to heritage assets, the main issue is the extent to which designated and non-designated assets are affected by the Proposed Scheme. Impacts on assets as a result of the Proposed Scheme will occur largely through the physical removal and alteration of assets and changes to their setting.

6.1.3 Maps showing the location of the key environmental features can be found in Volume 2: CFA 4 Map Book. Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5, Cultural Heritage Map Books. Detailed reports on the cultural heritage character and surveys undertaken within the local area are contained in the Volume 5 Appendices. These include:

- Appendix CH-001-004 - Baseline report;
- Appendix CH-002-004 - Gazetteer of heritage assets; and
- Appendix CH-003-004 - Impact assessment table.
- Throughout this section, assets within the study areas are identified with a unique reference code, KILXXX; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-004.

6.1.4 Engagement has been undertaken with the Greater London Archaeological Advisory Service and the English Heritage historic buildings advisor for London with regard to the nature of the cultural heritage assets within the area.

6.2 Scope, assumptions and limitations

6.2.1 The assessment scope, key assumptions and limitations for the cultural heritage assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000) and the SMR Addendum (Volume 5: Appendix CT-001-000). This report follows the standard assessment methodology.

6.2.2 The setting of all designated heritage assets in the zone of theoretical visibility (ZTV) of the Proposed Scheme has been considered. The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out, is defined as the land required, temporarily and permanently, to construct the Proposed

Scheme plus 250m. For the purposes of this assessment, any assets within the 10mm settlement contour[20] are included within the assessment.

6.2.3 The cultural heritage methodology includes the consideration of the intra-project effects of a number of technical topic assessments, e.g. landscape and visual, ecology and water resources and flood risk. Consequently, these interactions have been included in the assessment of impacts and effects.

6.2.4 In undertaking the assessment, not all areas of survey as identified in the archaeological risk model[21] were available for survey and this is a limitation of the assessment.

6.2.5 However non-intrusive field survey was undertaken in a number of areas to provide data regarding the nature of sub-surface archaeological assets. Information from other sources of data, including the historic environment record and local archives was utilised to provide information relating to the potential archaeological assets that may be present.

6.3 Environmental baseline

Existing baseline

6.3.1 In compiling this assessment, documentary baseline data was collected from a variety of sources as set out in Volume 5: Appendix CH-001-004.

6.3.2 In addition to collating this baseline data, walkover surveys and site reconnaissance was undertaken from areas of public access or in locations where access was granted. This was undertaken to understand the character and form of heritage assets and the historic landscape; to review the setting of assets; and to identify previously unknown assets.

Designated assets

6.3.3 The following designated heritage assets are located partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme (see Volume 5, Cultural Heritage Map Book):

- the Grade I listed registered park and garden Kensal Green (All Souls') Cemetery (KIL009);
- four Grade II* listed tombs within Kensal Green Cemetery (the tomb of Andrew Ducrow (KIL038), the tomb of John St. John Long (KIL039), the tomb of Mary Gibson (KIL040) and the tomb of William Mulready RA (KIL041);

[20] The area in which ground settlement is estimated to be 10mm in depth.
[21] The archaeological risk model is an approach that enables the identification of those areas of the Proposed Scheme where archaeological assets are known or suspected and provides a mechanism for the prioritisation of the programme of survey.

- 43 Grade II listed structures within Kensal Green Cemetery, including tombs and mausolea (KIL042-KIL084), their perimeter walls and railings (KIL085) and the parish boundary markers; and
- eight conservation areas: Kensal Green (KIL001), South Kilburn (KIL002), Grand Union Canal (KIL003), Old Oak Lane (KIL005), Kilburn (KIL006), Queen's Park Estate (KIL007), St. Mary's (KIL008) and Kensal Green Cemetery (KIL009).

6.3.4 The following designated assets are located within the ZTV (see Volume 2, CFA4 Map Book and Volume 5, Cultural Heritage Map Book):

- three Grade I listed buildings: the Anglican Chapel at Kensal Green (KIL010); the church of St. Augustine (KIL014); and the Church of St. Mary Magdalene (KIL109);
- 15 Grade II* listed buildings: the entrance gateway opposite Wellington Road, tomb to HRH Augustus Frederick, monument to HRH Princess Sophia, monument to Ninon Michaelis, tomb of Commander Charles Spencer Ricketts, tomb of Elizabeth and Alexis Soyer, tomb of Major General Sir William Casement and the Dissenters' Chapel all of which are within Kensal Green Cemetery (KIL009); the Paddington British Rail maintenance depot, west block (KIL109); All Saints Church (KIL112); Goldsmiths' Almshouses and railings fronting road (KIL117); Church of All Souls' (KIL118); Kensal House and Kensal House day nursery (KIL122); Chapel at HMP Wormwood Scrubs (KIL124); Mecca Bingo (KIL131) and Trellick Tower, Cheltenham Estate (KIL132).
- 182 Grade II listed buildings, the majority of which lie within Kensal Green Cemetery; and
- 15 conservation areas: Old Oak Lane (KIL005); Queen's Park (KIL006); Maida Vale (KIL109); Paddington Green (KIL110); Oxford Gardens (KIL111); Colville (KIL112); Wood Lane (KIL113); Old Oak and Wormholt (KIL114); Cleverly Estate (KIL115); Ingersoll and Arminger (KIL116); Acton Park (KIL117); Harlesden (KIL118); Paddington Cemetery (KIL119); North Kilburn (KIL120) and Brondesbury (KIL121).

Non-designated assets

6.3.5 The following non-designated assets of low value lie partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme, or within the 10mm settlement contour:

- 51-61 Kilburn High Street (KIL002);
- a bridge over the Grand Union Canal (Paddington branch) (KIL003);
- the North Pole British Rail Depot (KIL024);
- the Old Oak Common Rail Depot (KIL105);
- the North Acton Cemetery (KIL037);
- the Great Western Railway (KIL028);

- the Hampstead Junction Railway (KIL030);
- the Great Western and Great Central Joint Railway (KIL031);
- the West London Railway (KIL032);
- the North and South Western Junction Railway (KIL033);
- the Dudding Hill Loop Line (KIL034); and
- the Ealing and Shepherds Bush Railway (KIL035).

6.3.6 All non-designated heritage assets within 250m of the land required, temporarily or permanently, for the construction of the Proposed Scheme are listed in the gazetteer in CH-002-004 (Volume 5: Appendix CH-002-004) and identified on Map Series CH-01 (Volume 5, Cultural Heritage Map Book). There are a number of built heritage assets, the settings of which have been considered, for example:

- the West Kilburn assets group (KIL013);
- the Elizabeth Arden Building, Wales Farm Road (KIL016);
- the Kensal Green asset group (KIL017);
- numbers 1-167 Wells House Road (KIL018);
- the North Acton London Underground station (KIL019); and
- the North Acton Cemetery (KIL037).

Cultural heritage overview

6.3.7 The Proposed Scheme is geologically within the London Clay Formation with no superficial deposits recorded within British Geological Society data. Further details of the geology of the area are contained in Section 8. Previous land use is likely to have resulted in a cover of made ground within the area required for the construction of the Proposed Scheme with the exception of Kensal Green Cemetery. The topography of the area is largely level but slopes gradually down towards the south.

6.3.8 The oldest evidence is associated with the A5 Kilburn High Road, identified as the course of Watling Street (KIL094), a major Roman Road that is likely to follow the route of an earlier Iron Age trackway. The study area was located on the rural periphery of London throughout this period.

6.3.9 The study area is located within what was Middlesex Forest during the medieval period. Much of the forest was cleared throughout the medieval period in order to serve developing agricultural demands although a remnant survived at Wormwood Scrubs, known as Wormholt Wood, and Old Oak Common, known as Old Holt Wood. There is evidence of small scale settlement in the medieval period including Kilburn Priory to the east of Kilburn High Street, a settlement known as Kingisholt (KIL096)

located on the A404 Harrow Road, and a medieval moated site located at Willesden Junction (KIL096).

6.3.10 Analysis of the historic mapping has shown that by the 19th century the area was largely used as agricultural and pastoral land interspersed with small settlements, the majority of which were ribbon developments along the main roads into London. To the east of Old Oak Common was Acton Wells (KIL092) a retreat which Londoners came to for the health benefits of the pure water as early as 1612 and buildings lasting on the site until 1908[22]. By the mid-19th century the Grand Union Canal (KIL003), London to Birmingham Railway (KIL029) and the Great Western Railway (KIL028) had been constructed across the study area. By the end of the 19th century the land surrounding these transport corridors was increasingly developed to form much of the current street layout.

6.3.11 Central to the study area is Kensal Green Cemetery, a Grade I registered park and garden (KIL009). The cemetery was opened by the General Cemetery Company in 1833 and was the first commercial cemetery in London[23]. The cemetery has an extensive and complex layout designed by head gardener Richard Forrest and buildings designed in the Greek Revival style by the General Cemetery surveyor John Griffith[24]. The buildings include the Anglican Chapel, a Grade I listed building (KIL010).

6.3.12 Information provided on the London County Council Bomb Damage Maps[25] identified significant bomb impacts within the study area. This included severe damage to Mitre Wharf situated between the southern boundary of St. Mary's Cemetery (KIL008) and the northern edge of the GWML, and minor blast damage to many of the terraced houses along the southern side of the B413 Kilburn Lane and to the Grade I listed building, Anglican Chapel (KIL010).

Future baseline

Construction (2017)

6.3.13 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. None of the identified developments affect the assessment of the Proposed Scheme's likely construction impacts on heritage assets.

Operation (2026)

6.3.14 No committed developments have been identified in this local area that will materially alter the baseline conditions in 2026.

[22] Baker, T. F. T. and Elrington, C. R. (editors) (1982), *A History of the County of Middlesex: Volume 7: Acton, Chiswick, Ealing and Brentford, West Twyford, Willesden*.
[23] Weinreb, B., Hibbert, C., Keay, J. and Keay, J. (2008), *The London Encyclopaedia: third edition*, Macmillan, London.
[24] Curl, J.S. (2001), *Kensal Green Cemetery, The origins and development of the General Cemetery of All Souls, Kensal Green, London, 1824-2001*. Phillimore and Co Ltd, Chichester, pp. 1-20.
[25] The London Topographical Society (2005), *London County Council Bomb Damage Maps 1939-45*.

6.4 Effects arising during construction

Avoidance and mitigation measures

6.4.1 The draft CoCP sets out the provisions that will be adopted to control effects on cultural heritage assets. The provisions include the following (see Volume 5: Appendix CT-003-000):

- management measures that will be implemented for assets that are to be retained within the land required for the construction of the Proposed Scheme (draft CoCP, Section 8);
- the use of appropriate equipment and methods to limit ground disturbance and settlement followed by monitoring, protection and remediation (draft CoCP, Section 10);
- the preparation of project wide principles, standards and techniques for works affecting heritage assets (draft CoCP, Section 8);
- a programme of archaeological investigation and recording to be undertaken prior to/or during construction works affecting the assets (draft CoCP, Section 8); and
- a programme of historic building investigation and recording to be undertaken prior to modification or demolition of the assets (draft CoCP, Section 8).

Assessment of impacts and effects

Temporary effects

6.4.2 The construction works, comprising excavations and earthworks and including temporary works such as construction compounds, storage areas, and diversion of existing roads and services, have the potential to affect heritage assets during the construction period. Impacts will occur to assets both within the land required for the construction of the Proposed Scheme and assets in the wider study area due to the visibility of plant, cranes and equipment, as well as other construction factors.

6.4.3 Utility diversions and associated temporary works including gas main modifications requiring excavation of a trench and the erection of temporary hoarding around the proposed work area along Centre Avenue in Kensal Green Cemetery will alter the setting of the heritage assets within the cemetery. These works are expected to last approximately nine months, although activities maybe intermittent. The noise generated by construction, in particular, will have a medium adverse impact on the setting of the cemetery and its inherent peaceful nature. This will constitute a moderate adverse effect.

Cumulative effects

6.4.4 There will be no cumulative effects from temporary impacts on heritage assets within the study area.

Permanent effects

6.4.5 Permanent significant effects can occur either as a result of physical impacts on heritage assets within the land required, temporarily or permanently, for construction of the Proposed Scheme, or through changes to the setting of heritage assets through the presence of the Proposed Scheme.

Physical impacts

6.4.6 The site of a medieval manor house (KIL093), an asset of low value, may be affected by utility diversions and associated temporary works including gas main modification on Oxford Road where previously undisturbed ground is encountered. If this occurs, this will constitute a high adverse impact and moderate adverse effect.

6.4.7 The non-designated carriage shed (KIL105) at Old Oak Common station, an asset of low value, currently the FGW depot building, is scheduled for demolition. This will constitute a high adverse impact and moderate adverse effect.

6.4.8 The Iron Age to Roman Road (KIL094), an asset of low value may be affected by utility diversions and associated temporary works including gas main modification on the A5 Kilburn High Road if previously undisturbed ground is encountered. If this occurs, this will constitute a high adverse impact and moderate adverse effect.

Impacts on the setting of heritage assets

6.4.9 As the Proposed Scheme is largely in tunnel with limited surface features, there will not be any significant permanent construction effects on the setting of heritage assets.

Permanent cumulative effects

6.4.10 There will be no cumulative effects from permanent impacts on heritage assets within the study area.

Other mitigation measures

6.4.11 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the draft CoCP will be considered during detailed design to reduce further the significant effects described previously.

Summary of likely residual significant effects

6.4.12 Archaeological assets may be permanently lost due to the construction of the Proposed Scheme; including the site of a medieval manor house (KIL093) and an Iron Age Roman Road (KIL094). A programme of archaeological works will be prepared to investigate, analyse, report and archive these assets.

6.4.13 The Proposed Scheme will result in the demolition of the carriage shed (KIL094) at Old Oak Common. A programme of built heritage works will be prepared to investigate, analyse, report and archive these assets.

6.4.14 The Proposed Scheme will not significantly alter the setting of any built heritage assets, or change the historic townscape of the area.

6.5 Effects arising from operation

Avoidance and mitigation measures

6.5.1 No measures have been required to reduce the impacts and effects on assets.

Assessment of impacts and effects

6.5.2 The assessment considers the Proposed Scheme once operational and all effects are considered to be permanent. There will be no physical impacts on buried archaeological remains or other heritage assets arising from the operation of the Proposed Scheme. Impacts on the setting of heritage assets arising from the physical presence of the Proposed Scheme are described as permanent occurring within the construction phase and are not repeated in detail here, albeit that they will endure through the operation of the Proposed Scheme. Where there is a combined effect on the setting of an asset from the presence of the constructed Proposed Scheme and its operation, this is reported in the assessment of operation.

6.5.3 As the route is in tunnel in this area, there will be no additional noise or visual impacts from the operation of the railway. As such, there are no significant operational effects.

Permanent effects

6.5.4 No significant effects will occur as a result of physical impacts on heritage assets within the land required, temporarily and permanently, for the construction of the Proposed Scheme.

6.5.5 As the Proposed Scheme is largely in tunnel with limited surface features, no significant permanent construction effects on the setting of heritage assets have been predicted in this assessment.

Permanent cumulative effects

6.5.6 There will be no cumulative effects from impacts on heritage assets within the study area.

Other mitigation measures

6.5.7 No additional mitigation measures are considered necessary.

Summary of likely residual significant effects

6.5.8 There are no significant residual effects.

7 Ecology

7.1 Introduction

7.1.1 This section describes the ecological baseline and identifies likely impacts and significant ecological effects that will arise from the construction and operation of the Proposed Scheme. These include impacts on species, habitats and sites designated for their importance for nature conservation.

7.1.2 The principal ecological issues in this area are the loss of habitat in Acton Railsides Site of Borough Importance Grade 1 (SBI.I) and Silverlink Metro and Dudding Hill Loop in Ealing Site of Borough Importance Grade 2 (SBI.II), and the loss of trees and buildings with the potential[26] to support bat roosts.

7.1.3 Volume 5 of the Environmental Statement contains supporting information to the ecological assessment reported in this section, including:

- ecological baseline data (Volume 5: Appendices EC-001-001, EC-002-001, EC-003-001, and EC-004-001); and
- register of local/parish level effects which are not described individually in Volume 2 are reported in Volume 5: Appendix EC-005-001.

7.1.4 As well as survey data, the assessment draws on existing information gathered from national organisations and from regional and local sources including Greenspace Information for Greater London, London Wildlife Trust and London Bat Group.

7.2 Scope, assumptions and limitations

7.2.1 The scope and methodology of the ecological assessment are introduced in the SMR (Volume 5: Appendix CT-001-000/1) and SMR Addendum (Volume 5: Appendix CT-001-000/2). The assessment methodology is summarised in Section 8 of Volume 1, along with route-wide assumptions and limitations. Limitations associated with particular surveys are reported in Volume 5: Appendices EC-001-001, EC-002-001, EC-003-001 and EC-004-001.

7.2.2 A Water Framework Directive (WFD) assessment has been undertaken in conjunction with the environmental assessment. Details of this assessment are presented in Volume 5: Appendix WR-001-000.

7.2.3 It should be noted that the baseline information provided in Section 7.3 does not include descriptions of designated sites, habitats and species above the bored tunnel where no impacts on ecological receptors are anticipated.

[26] A feature which is identified as being of potentially suitable to support roosting bats. Potential roosts are graded as being of low, moderate or high potential to support bats depending on the likely suitability of the feature concerned.

7.2.4 The scheme design, the urban location of the Proposed Scheme and the absence or limited extent of suitable habitats means that some species and species groups have been scoped out of the assessment. This is because the habitats that support them are not present (e.g. no natural rivers), or are considered inherently unsuitable for species of interest due to their man-made nature (e.g. concrete walled canals). Within this area these species groups and species include white-clawed crayfish, amphibians, badger and dormouse. In addition, as no impacts are expected on aquatic invertebrates and fish they were removed from the survey scope. Further information is presented in Volume 5: Appendices EC-001-001, EC-002-001, EC-003-001, and EC-004-001.

7.2.5 Access was not obtained to all of the land area where general habitat survey (Phase 1 habitat survey) was proposed. Partial Phase 1 habitat survey was carried out from PRoW for areas where access was not permitted. Locations with the potential to support key ecological receptors where access was not permitted for detailed survey includes Wormwood Scrubs park, Little Wormwood Scrubs, railway land at Old Oak Common. Access could not be gained for survey of a number of buildings and trees, including those within in railway land. Further details are provided in Volume 5: Appendices EC-001-001, EC-002-001, EC-003-001 and EC-004-001.

7.2.6 Where data are limited, a precautionary baseline has been built up according to the guidance reported in the SMR (Volume 5: Appendix CT-001-000/2) and SMR Addendum (Volume 5: Appendix CT-001-000/2). This constitutes a 'reasonable worst case' basis for the subsequent assessment.

7.2.7 A precautionary approach to the assessment has been adopted to identify the likely significant ecological effects of the Proposed Scheme.

7.3 Environmental baseline

Existing baseline

7.3.1 This section describes the ecological baseline relevant to the assessment: the designated sites, habitats and species recorded in this area. Further details are provided in the reports presented in Volume 5: Appendix EC-001-001, EC-002-002, EC-003-001, EC-004-001 and Map Series EC-01 to EC-12 (Volume 5, Ecology Map Book CFA4). Statutory and non-statutory designated sites are shown on Maps EC-01-004b to EC-01-005 (Volume 5, Ecology Map Book CFA4).

7.3.2 Land required for the construction of the Proposed Scheme and that adjacent to it consists of a predominantly built environment in the east, comprising the Queen's Park and Kilburn areas. By contrast, the western part at Old Oak Common and North Acton contains extensive light industrial areas with fragmentary brown-field land. Parts of the Old Oak Common railway depot and associated railway corridors contain

wildlife habitat as does the Grand Union Canal corridor. There is a large green space[27] at Wormwood Scrubs and there are also several large cemeteries in the area.

Designated sites

7.3.3 There is one statutory designated site located within 500m of the land required for the construction of the Proposed Scheme. Wormwood Scrubs LNR comprises grassland and a number of species of native trees. The site also supports common lizards and over 100 species of birds have been recorded, along with common mammals and invertebrates including stag beetle a Species of Principal Importance identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[28] and an Ealing Biodiversity Action Plan (BAP) species[29]. A small part of this site is required for utility works associated with the re-grading and widening of Old Oak Common Lane and the associated bridge works associated with the Proposed Scheme. The site is of district/borough value.

7.3.4 There are 10 Local Wildlife Sites relevant to the assessment in this area[30]. They are:

- London Canals Site of Metropolitan Importance (SMI) - the site supports a number of scarce wetland plants and uncommon plants on banks, brickwork and towpaths, though locations are not provided by the citation. The canal supports bird, invertebrate, fish species and water vole where suitable habitat occurs. The site is adjacent and beneath the land required for the construction of the two conveyors and the temporary road bridge allowing connections between the Willesden Euroterminal main compound and the Atlas Road satellite compound for the Proposed Scheme and is of county/metropolitan value;
- Kensal Green Cemetery SMI - species rich grassland supporting regionally rare plant species, a variety of breeding birds and a nationally declining butterfly species. The vegetated masonry has a diverse community of ferns, mosses and lichens. The site is located within land potentially required for utilities works for the Proposed Scheme and is of county/metropolitan value;
- Wormwood Scrubs Railway Embankment SBI.I - comprises woodland. Further south the embankment becomes more open, with a mixture of bramble, rough grassland and tall herbs. The site is located partly within the land required for the construction of the Proposed Scheme and is of district/borough value;
- Wormwood Scrubs Park SBI.I - includes damp and dry acid grassland that support good populations of common reptiles and common butterflies. The site also includes a wide variety of trees that support nesting birds. Migratory

[27] Green spaces are areas of natural or semi-natural land e.g. parks, gardens and woodlands.
[28] *Natural Environment and Rural Communities (NERC) Act 2006*, (c.16), *Section 41: Species of Principal Importance in England*, Her Majesty's Stationery Office, London.
[29] Ealing Council (1999), *Ealing Biodiversity Plan*; http://www.ealing.gov.uk/info/200588/nature_conservation/630/getting_involved/2; Accessed: October 2013.
[30] Little Wormwood Scrubs SLI is not adjacent to the route and therefore not being assessed as part of CFA4. This is the approach as set out in the SMR (Volume 5: Appendix -0CT-001-000/1) and SMR Addendum (Volume 5: Appendix -0CT-001-000/2). Assessment of Little Wormwood Scrubs SLI has been carried out as part of the HEx assessment (see assessment Volume 4).

birds also utilise the site which also attracts rarer bird species such as marsh harriers, whinchats and common redstart. A small section of this site is within the land required for the construction of the Proposed Scheme and is of district/borough value;

- Old Oak Common Sidings Birch Wood SBI.I - small woodland dominated by silver birch trees fringed with scrub. A good range of butterflies are found in the more open parts of the site. The site is adjacent to the land required for the construction of the Proposed Scheme and is of district/borough value;

7.3.5 Central Line West of White City SBI.I - comprises undisturbed railside corridor habitat that are well vegetated with scrub and occasional grassy clearings and patches of sycamore woodland. The scrub consists of hawthorn, goat willow, crack willow, elder and butterfly-bush. The site is adjacent to the land required for the construction of the Proposed Scheme and is of district/borough value;

- Acton Railsides SBI.I - wide rail cuttings with areas dominated by woodland and scrub and other more open areas dominated by grassland and tall herb habitats, managed to prevent woody species establishing. Piles of sand and bare ground provide habitat for reptiles and many invertebrates. The site is partly within the land required for bridge widening works, the realignment of the GWML and the removal of the ANL. It is of district/borough value;
- St. Mary's Cemetery SBI.II has a number of mature tree specimens. The graves support higher plants and lichens. The site is adjacent to the area required for the Proposed Scheme and is of district/borough value;
- Silverlink Metro and Dudding Hill Loop in Ealing SBI.II - includes limited semi-natural habitat in narrow strips. Ruderal vegetation is quite frequent. Other sections of the site include woodland and scrub. The site is partly within the land required for the installation of the conveyors linking Victoria Road tunnel drive main compound to the Atlas Road satellite compound and the installation of a new electrical connection and is of district/borough value; and
- North Acton Cemetery Site of Local Importance (SLI) which comprises flower-rich grasslands with a variety of herbs, including species usually indicative of old unimproved grassland. Mature tree specimens are also present. The site supports invertebrate and bird species. The SLI is located adjacent to the land required for the construction of the Proposed Scheme and is of local/parish value.

Habitats

7.3.6 The following habitat types which occur in this area are relevant to the assessment.

Grassland

7.3.7 In the cemeteries, especially Kensal Green Cemetery, some areas of amenity turf are especially rich in herbs including species not all that widespread in such urban areas. Parks, gardens, city squares, school grounds, churchyards and cemeteries is a Kensington and Chelsea BAP habitat. Kensal Green Cemetery is a flagship site in the

Kensington and Chelsea BAP[31]. Grasslands are a Brent BAP habitat[32]. The grassland is the primary reason for designation of Kensal Green Cemetery SMI. This grassland is of county/metropolitan value.

7.3.8 Rough grassland is present in Wormwood Scrubs. This grassland is managed as meadows and less frequently mown. The grassland managed as meadow is one of the primary reasons for designation in Wormwood Scrubs Park SBI.I. This grassland is of district/borough value.

7.3.9 Amenity turf is present in Wormwood Scrubs park and by the towpath of the Grand Union Canal. This grassland is of local/parish value. Stands of semi-improved grassland are also present at Wormwood Scrubs. This grassland is of local/parish value.

Water bodies

7.3.10 The Grand Union Canal is a body of very slow-moving eutrophic fresh water. The water body supports submerged stands of aquatic plants and sparse water-margin vegetation. Canals are a Hammersmith and Fulham BAP habitat. Freshwater habitats and green corridors are Kensington and Chelsea BAP habitats. Wetland habitats are a Brent BAP habitat. The Grand Union Canal forms part of a London-wide site, the London Canals SMI that, as a whole, is of county/metropolitan value.

Woodland

7.3.11 One area of recent secondary woodland, comprising naturally regenerated birch woodland, is present on former railway land between the Old Oak Common depot and the Grand Union Canal. The area of woodland forms part of the Old Oak Common Sidings Birch Wood SBI.I. Trees, woodland and scrub are Hammersmith and Fulham BAP[33] habitats. Trees, woodland and hedgerows are Brent BAP habitats. This developing secondary birch woodland is of district/borough value.

7.3.12 Developing secondary woodland which has established from naturally regenerating scrub is present on the railway in this area, particularly to the south of Wells House Road, within the Acton Railsides SBI.I. This developing secondary woodland is of district/borough value.

7.3.13 Other woodland in the area includes recently planted plantation woodland, consisting of young trees at the edge of Wormwood Scrubs. This woodland consists of diverse tree-planting stock, amongst which fast-growing species predominate including false acacia, a non-native species. These areas of secondary woodland form part of Wormwood Scrubs Railway Embankment SBI.I and are of district/borough value.

[31] Royal Borough of Kensington and Chelsea, *Royal Borough of Kensington and Chelsea Local Biodiversity Action Plan 2010/11 - 2014/15*, http://www.rbkc.gov.uk/pdf/PRINT_LBAP2010_2015_V3_reduced%20PR_SL-%20Appx%202.pdf; Accessed October 2013.
[32] Brent Council (2007), *London Borough of Brent Biodiversity Action Plan 2007*; http://www.brent.gov.uk/media/325129/Brent's%20Biodiversity%20Action%20Plan%202007.pdf; Accessed October 20013.
[33] Hammersmith and Fulham Borough Council (undated), *Investigation Hammersmith and Fulham Draft Biodiversity Action Plan (BAP) (2004-2006);* http://www.lbhf.gov.uk/external/la21/pdf/HFBiodiversityActionPlan.pdf.

7.3.14 Further areas of plantation are present on the northern side of the Grand Union Canal. This woodland is of local/parish value.

Mosaic and transition habitats

7.3.15 Three main types have been identified within the railway land, and to a limited extent, east of Old Oak Common depot. The three types comprise varying complexes of scrub, rough grassland tall-herb ruderal vegetation and bare ground in differing proportions. Mosaic and transition habitats are present within Acton Railsides SBI.I and Central Line West of White City SBI.I. Railway land and corridors are a Hammersmith and Fulham BAP habitat. Railway land has a Habitat Statement within the Ealing BAP[34]. These complexes of scrub, rough grassland and ruderal vegetation collectively are of district/borough value.

Scrub

7.3.16 Naturally regenerating thorn scrub occurs in small fragments in this area, mostly around the edges of the parks, along the banks of the Grand Union Canal, and on the wider railway land around line intersections east of Old Oak Common depot, within Acton Railsides SBI.I, Central Line West of White City SBI.I, and in Silverlink Metro and Dudding Hill Loop in Ealing SBI.II. Trees, woodland and scrub are Hammersmith and Fulham BAP habitats. Trees, woodland and hedgerows are Brent BAP habitats. The scrub is of local/parish value.

Hedgerows

7.3.17 The cemeteries include garden and park hedges and evergreen shrubs. Species include garden privet and evergreen shrubs, both broad-leaved, e.g. escallonia, holly or cherry laurel; and coniferous, e.g. Lawson's cypress, yew. The hedgerows are of local/parish value.

Other habitats

7.3.18 All other habitats are of local/parish value or below. Full descriptions are provided in Volume 5: Appendices EC-001-001, EC-002-001, EC-003-001 and EC-004-001.

Protected and/or notable species

7.3.19 A summary of the species relevant to the assessment is provided in Table 8.

[34] Ealing Council (1999), *Ealing Biodiversity Plan*; http://www.ealing.gov.uk/info/200588/nature_conservation/630/getting_involved/2; Accessed: October 2013.

Table 8: Protected and/or notable species

Species/ species group	Value	Receptor	Baseline and rationale for valuation
Birds	National	Black redstart to the west of St. Mary's Roman Catholic Cemetery and Wormwood Scrubs	A single male holding territory was recorded to the west of St. Mary's Roman Catholic Cemetery. While no evidence of breeding was recorded, the presence of an individual holding territory represents more than 1% of the national population of this species. This is therefore of national importance. No other black redstarts were recorded during surveys in this section of the Proposed Scheme. However, further areas of habitat which are more suitable for black redstarts, including the railway land and light industrial areas were not surveyed due to access restrictions. Desk study indicates black redstart have previously been recorded at Wormwood Scrubs, although these records did not report evidence of breeding. Black redstart are a Hammersmith and Fulham BAP species and Kensington and Chelsea BAP species.
	District/borough	Breeding bird assemblage at Wormwood Scrubs	A total of 28 notable species were recorded at Wormwood Scrubs, 13 of which were considered to be definitely or possibly breeding. Most were of no particular significance within a London context, but breeding meadow pipits are important in a borough context.
	Local/parish	Breeding bird assemblage at St. Mary's Roman Catholic Cemetery	The breeding bird population is of local interest only being comprised of common and widespread species.
	Local/parish	Breeding bird assemblage at the Grand Union Canal at Old Oak Common, Little Wormwood Scrubs and Kensal Green All Souls Cemetery	The assemblage of waterbirds breeding in or using the canal was unremarkable. The remainder of the breeding bird community comprised common and widespread species adapted to living in a built-up environment. Peregrine falcons were recorded flying over Kensal Green Cemetery and the Grand Union Canal during the field survey. These sites were assessed as of local value as they had less diverse assemblages containing fewer notable species then Wormwood Scrubs.
	Local/parish	Wintering bird assemblage at Wormwood Scrubs	Winter bird surveys undertaken from PRoW at Wormwood Scrubs recorded a total of 30 species. This is a low total for the site and is likely to be a reflection of the survey limitations, rather than species presence. However, if further survey visits had occurred, it is considered unlikely that the winter species richness would have increased to above local/parish significance. Eleven notable species were recorded. Four of these are red list species and seven amber list species. There were large numbers of ring-necked parakeet and carrion crow. However, the parakeet is introduced and the crow is abundant in London. No other notable flock sizes were recorded. Desk study data indicates the site has generated a long list of casual records but the regular winter assemblage is unremarkable.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
Bats	Up to county/metropolitan	Bat assemblages roosting in buildings, structures and trees in Kensal Green Cemetery, Victoria Road bridge, Old Oak Common railway land and in trees along the Grand Union Canal	Field survey recorded no roosts however access restrictions prevented some initial inspection and detailed survey, particularly in the railway land. One tree adjacent to the Grand Union Canal was recorded as having moderate potential to support roosting bats. One building and other structures containing features with a moderate potential to support hibernation roosts were recorded, including a brick building, built into the side of the Victoria Road bridge to the east of North Acton London Underground station and a number of tombs/mausoleums at Kensal Green Cemetery. Given the lack of access, it is not possible to rule out that some trees, buildings and structures may potentially support maternity roosts of common bats such as pipistrelles or roosts of rarer bats even in this urban environment. Therefore a precautionary valuation has been applied. All bats are London BAP species[35]. Bats are a Kensington and Chelsea BAP species.
	Local/parish	Assemblages of bats commuting and foraging in railway land at Old Oak Common, at the Grand Union Canal and Wormwood Scrubs	The transect surveys along the Grand Union Canal north of Old Oak Common regularly recorded low levels of commuting by common and soprano pipistrelles, however on occasion greater numbers of pipistrelles were recorded with up to 18 individuals on one survey visit. Myotis and serotine bats were recorded on only one occasion and just single passes. The static surveys recorded low levels of activity from common pipistrelles and a few passes of noctule and other serotine or Leisler's bats. The transect surveys from PRoW at Wormwood Scrubs recorded regular, very low level, dispersed commuting and foraging activity from common and soprano pipistrelle bats with a single pass also recorded from a noctule bat. Soprano pipistrelle and noctule bat are species of principal importance.
Terrestrial invertebrates	Up to county/ metropolitan	Terrestrial invertebrate assemblages at Wormwood Scrubs	This area was not subject to survey, but desk study indicates it supports an invertebrate assemblage likely to be of interest in London.
	Up to district/borough	Terrestrial invertebrate assemblages at Kensal Green Cemetery	Eight species were recorded during the surveys at Kensal Green Cemetery that are considered to be of conservation interest in this area of London (see Volume 5: Appendix EC-004-001).

[35] London Biodiversity Partnership, *London BAP's Priority Species*. http://www.lbp.org.uk/londonpriority.html; Last accessed: 2 October 2013.

Species/ species group	Value	Receptor	Baseline and rationale for valuation
	Up to district/borough	Terrestrial invertebrate assemblages on railway land at Old Oak Common and west of Old Oak Common	This area was not subject to field survey, but field survey in adjoining railside habitats have shown the areas of railway corridor are generally of low interest. Collectively, they form a movement corridor and a habitat feature likely to be important to invertebrate populations across this area of London.
	Local/parish	Terrestrial invertebrate assemblages at St. Marys Roman Catholic Cemetery	Three species of conservation significance were recorded during the surveys at St. Mary's Roman Catholic Cemetery however a low number of species were recorded overall. The quality of habitats is considered to be low for invertebrates.
	Local/parish	Terrestrial invertebrates assemblages in other habitats	The other habitats are considered to be of low interest for terrestrial invertebrate assemblages.
Common reptiles	District/borough	Common reptile population at Wormwood Scrubs and adjacent railway land at Old Oak Common	Desk studies indicate some suitable habitat is present for common reptiles within the land at Old Oak Common junction and along the existing railways, although no field surveys were undertaken. Desk study indicates slow worm and common lizard have been recorded along the railway land at Old Oak Common and Wormwood Scrubs. It is likely that common reptiles will be present along the existing railway within the Proposed Scheme. Given the extent of suitable habitat at Wormwood Scrubs, it is possible that moderate populations of slow worm and common lizard could be present here and throughout the adjoining railway land. The presence of a moderate population of two common species, which would be of district/borough importance in this urban area. Slow worm, grass snake and common lizard are a species of principal importance and all reptiles are London BAP priority species. Slow worm are an Ealing BAP species.

Future baseline

Construction (2017)

7.3.20 A summary of the known developments which are assumed to be mostly built and occupied prior to construction of the Proposed Scheme is provided in Volume 5: Appendix CT-004-000. None of these developments will affect the character and value of ecological resources.

Operation (2026)

7.3.21 There are no known committed developments in this area that will affect the operational baseline.

7.4 Effects arising during construction

Avoidance and mitigation measures

7.4.1 As the route is within tunnel it avoids or reduces impacts on features of ecological value.

7.4.2 The assessment also assumes implementation of the measures set out within the draft CoCP, which includes translocation of protected species where appropriate.

Assessment of impacts and effects

7.4.3 No significant effects have been identified in relation to ecological receptors in the vicinity of Salusbury Road vent shaft.

Designated sites

7.4.4 Bridge widening works and the realignment of the GWML, together with the removal of the ANL, will result in the loss of approximately 9.2ha of Acton Railsides SBI.I, representing 19% of the site. The SBI.I is also concurrently being adversely affected by works in the adjacent Northolt Corridor area (CFA5), resulting in the loss of a further approximate 1.8ha, amounting to 23% of the SBI.I overall. The loss of this area of habitat will result in fragmentation of the SBI.I at the location of the works, though some partial connectivity will be retained. In combination, these impacts will result in a permanent adverse effect on site integrity that is significant at the district/borough level.

7.4.5 The installation of the conveyors linking the Victoria Road tunnel drive main compound to the Atlas Road satellite compound and the installation of a new electrical connection will result in the loss of approximately 2.4ha of Silverlink Metro and Dudding Hill Loop in the Ealing SBI.II, representing 18% of the site. While connectivity will remain along the length of the works, the habitat loss will result in a permanent adverse effect significant at the district/borough level.

7.4.6 No significant effects are reported for the following designated sites which form part of the baseline: Wormwood Scrubs LNR, London Canals SMI, Kensal Green Cemetery SMI, Wormwood Scrubs Railway Embankment SBI.I, Wormwood Scrubs Park SBI.I, Old Oak Common Sidings Birch Wood SBI.I, St. Mary's Cemetery SBI.II and North Acton Cemetery SLI.

Habitats

7.4.7 The construction works at Old Oak Common for the station and supporting utilities will result in the loss of approximately 3ha of mosaic and transition habitats which fall in Acton Railsides SBI.I. Habitat loss will occur along approximately 2.1km of the railway within this area. In addition, further areas of mosaic and transition habitat will be lost, approximately 1.8ha along 2.5km of railway in the Northolt Corridor area (CFA5).

7.4.8 While these individual areas of loss of mosaic and transition habitat will have not more than local parish effects on the conservation status of this habitat, the cumulative loss and subsequent adverse effects on the functionality and connectivity and therefore conservation status of the habitat will result in a permanent adverse effect that is significant at the district/borough level.

7.4.9 The construction works at Old Oak Common for the station and supporting utilities will result in the loss of approximately 6ha scrub habitat which partly lies in the Acton Railsides SBI.I and of Silverlink Metro and Dudding Hill Loop in the Ealing SBI.II. This will result in a permanent adverse effect on the conservation status of the habitat significant at the district/borough level.

7.4.10 It is considered unlikely that any other effects on habitat receptors at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-001.

Species

7.4.11 The removal or disturbance of habitat features that are utilised by bats during breeding, hibernation or migrating between roosts are considered to have the potential to result in adverse effects on the bat populations or assemblages during construction. However, the point at which such impacts are considered likely to result in a significant adverse effect on the conservation status of the population concerned will differ dependent on the status of the species concerned.

7.4.12 A small number of buildings and trees with the potential to support bat roosts will be removed, disturbed or demolished for the preparation works required in the railway land. This includes construction compounds and new station development in this area. Whilst there are alternative roost sites in the area, the loss of buildings and trees has the potential to result in the loss of maternity roosts which, it is assumed on a precautionary basis, could be present, e.g. in buildings in Old Oak Common railway land, trees along the Grand Union Canal and hibernation roosts potentially present at Victoria Road bridge and other railway bridges not accessed. This will have a permanent adverse effect on the conservation status of the local bat assemblage, which would be significant at up to the county/metropolitan level.

7.4.13 Losses of other habitat within the land required for the construction of the Proposed Scheme may require some bats to travel further, and expend more energy during day to day foraging and movement throughout their home range for the duration of construction. However, such effects alone are for all species considered unlikely to result in sufficient disturbance of the populations concerned to result in an adverse effect on their conservation status.

7.4.14 The construction of an aerial conveyor system, approximately 3.3m above ground level over the Grand Union Canal, with supports set back from the canal banks, will likely alter the flight paths of foraging and commuting bats slightly at this location.

The bats are likely to adapt to the new feature in their landscape, however it may temporarily deter small numbers of pipistrelle, serotine and *Myotis* bats from foraging at this location. The effect of the construction of the conveyor on foraging and commuting bats is unlikely to significantly affect the populations concerned.

7.4.15 The railway upgrade works may remove small areas of habitat which are suitable for black redstart. However, there is extensive alternative nesting habitat in the area and the habitat loss is therefore not considered to affect the conservation status of this species. In addition, the draft CoCP includes timing for works outside the breeding season, should birds be encountered during construction. The loss of habitat would not result in a significant effect on black redstart.

7.4.16 It is considered unlikely that any other effects on species receptors significant at more than the local/parish level will occur. Local/parish level effects are listed Volume 5: Appendix EC-005-001.

Other mitigation measures

7.4.17 This section describes additional measures designed to reduce or compensate for significant ecological effects. These include habitat restoration in railway land and new habitat creation at the new station development and compensatory wetland habitat creation at Wormwood Scrubs.

7.4.18 Mitigation for the loss of Acton Railsides SBI.I, Silverlink Metro and Dudding Hill Loop in Ealing SBI.II and the loss of associated mosaic and transition habitat and scrub habitat in the railway land will include the restoration of 11.6ha to equal that lost during construction. Habitats will be restored to the same condition; however an establishment period will result in a delay of approximately five years. These habitats will be enhanced through the provision of deadwood log piles, wildflower grass areas and bare ground. These measures, together with the compensatory planting at Wormwood Scrubs will reduce the effects on the designated sites to a level that is not significant.

7.4.19 Given that opportunities to mitigate at the site of the impact are limited, a compensatory area of new wetland planting will be provided in the southern part of Wormwood Scrubs at a site which is within the boundaries of the Proposed Scheme. This will include the creation of seasonal pools and scrapes with swales planted with locally appropriate wet loving species such as rushes and sedges and areas of wildflower grassland and native shrubs. The new habitats will be sited appropriately to allow continued use of the recreational sports pitches within the defined area linking to existing areas of woodland and grassland habitats (see Map CT-06-008-L1 (Volume 2, CFA 4 Map Book)).

7.4.20 The loss of any bat roosts in buildings, structures and trees will be compensated for by the provision of alternative compensatory roosts in accordance with the principles set out in the SMR (Volume 5: Appendix CT-001-000/1) and SMR Addendum (Volume 5:

Appendix CT-001-000/2). Should roosts be affected by construction of Old Oak Common station or Victoria Road bridge, alternative bat roost habitat will be integrated into the rail bridges and station design. Following the implementation of the mitigation measures proposed, there will be no significant effects on the conservation status of the species concerned.

Summary of likely residual significant effects

7.4.21 No significant residual effects are likely at the construction stage.

7.5 Effects arising from operation

Avoidance and mitigation measures

7.5.1 No measures have been included as part of the design of the Proposed Scheme to avoid or reduce impacts on features of ecological value.

Assessment of impacts and effects

7.5.2 The route is within tunnel in this area which would avoid collision risk impacts on bats.

7.5.3 No significant effects at operation have been identified.

Other mitigation measures

7.5.4 No additional mitigation measures for the operational stage are required.

Summary of likely residual significant effects

7.5.5 No significant residual effects have been identified at the operation stage.

8 Land quality

8.1 Introduction

8.1.1 This section of the report presents the baseline conditions that exist along the proposed route in relation to land quality and reports the likely impacts and any significant effects as a result of the construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, either from a scientific, mining or mineral resources point of view, including: geological sites of special scientific interest (SSSI), local geological sites (LGS), areas of current underground or opencast mining, and areas of designated mineral resources. Mitigation measures are presented and any residual effects are summarised.

8.1.2 Potentially contaminated areas of land have been identified that could affect, or be affected by, the construction of the Proposed Scheme (e.g. contaminated soils may need to be removed or the construction may alter existing contamination pathways). Each of these areas has been studied in order to evaluate the scale of potential impacts caused by existing contamination (if present) and what needs to be done to avoid significant consequences to people and the wider environment. In addition, a review has been undertaken to establish whether the operation of the Proposed Scheme will lead to contamination of its surrounding environments and what needs to be done to prevent such contamination.

8.1.3 The main environmental features of this area relevant to land quality include the Grand Union Canal and residential receptors.

8.1.4 The main land quality issues in this area include:

- extensive former industry, existing industrial estates and the Old Oak Common depot which are located in the western part of the study area. The latter has a long history of rail use and land beneath this area is known to have been impacted by this land use; and
- the former print works and adjacent railway land at the location of the Salusbury Road vent shaft.
- Details of baseline information and the land quality assessment methodology are presented in the following (contained in Volume 5):
- the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2); and
- Volume 5: Appendix LQ-001-004: Land quality.

8.1.5 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Section 13. Issues

regarding the disposal of waste materials including contaminated soils are addressed in Volume 3, Section 16.

8.1.6 Engagement has been undertaken with LBB, RBKC, LBHF and LBE environmental health departments, the petroleum officer at the London Fire Brigade, and the Environment Agency. Information or responses have been received from all parties except LBE.

8.2 Scope, assumptions and limitations

8.2.1 The assessment scope, key assumptions and limitations for the land quality assessment are set out in Section 8 of Volume 1 and in the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This section follows the standard assessment methodology.

8.2.2 Baseline data was reviewed for the area of land required to construct the Proposed Scheme, excluding areas of proposed utility works on the highway and proposed train stabling areas to the east of Old Oak Common[36], together with a buffer generally extending out for a further 250m, and in the case of groundwater data up to 1km. This wider area is defined as the study area.

8.2.3 Familiarisation visits to the study area were made in July 2012 where the location of the Proposed Scheme was viewed from points of public access only. Due to access constraints not all sites considered to have the greatest potential for contamination were visited. However, the purpose of site visits is to verify desktop information and the lack of complete site walkovers is considered unlikely to have substantially affected the land quality assessment. Site visit notes are presented in Volume 5: Appendix LQ-001-004.

8.3 Environmental baseline

Existing baseline

8.3.1 Unless stated otherwise, all features described in this land quality section are presented on Maps LQ-01-004b to LQ-01-005 (Volume 5, Land Quality Map Book).

Geology

8.3.2 This section describes the underlying ground conditions within the study area. It first describes any made ground present, followed by near surface superficial deposits and lastly describes the deeper bedrock geology. The geological mapping is illustrated in Map WR-02-004 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

8.3.3 Made ground has not been indicated as present by published geological mapping[37], although a cover of made ground is likely to be present throughout the area (with the exception of Kensal Green Cemetery) due to previous cycles of development.

8.3.4 In particular, within the railway land and Old Oak Common sidings area, made ground comprising track bed materials as well as other materials including a proportion of ash and clinker is known to be present and is known to be at least in part contaminated[38].

8.3.5 Geological mapping indicates that there are no superficial deposits present in the study area.

8.3.6 The London Clay Formation underlies the whole of the study area: this is a blue-grey clay that weathers to a brown colour in its upper part.

8.3.7 The geological succession beneath the London Clay generally comprises the following:

- the Harwich Formation, a thin sandy deposit (potentially only very localised);
- the Lambeth Group (also termed the Woolwich and Reading Formations) which comprises a mixture of clay, sand and occasional pebble beds;
- the Thanet Sand Formation is a dense green sand potentially only very thin and very localised in this area, although in the most part likely to be absent; and
- the Chalk Group, which is a soft white limestone.

Groundwater

8.3.8 The London Clay which immediately underlies the area has been designated by the Environment Agency as unproductive strata (i.e. is not a usable groundwater resource).

8.3.9 No groundwater source protection zones (SPZ) are present in the study area.

8.3.10 The Environment Agency reports that there are four licensed groundwater abstractions within the study area. There is the potential for unlicensed abstractions to be present, as a licence is not required for abstraction volumes below 20m^3 per day however none have been identified within the study area. Details are presented in Volume 5: Appendix WR-002-004. The abstractions are classified as high value receptors. Further detail on the groundwater beneath the Proposed Scheme can be found in Section 13 of this report.

Surface waters

8.3.11 The route runs beneath the Grand Union Canal to the south-west of Kensal Green Cemetery and east of Mitre Bridge.

[37] Geological Survey of Great Britain (2006), *North London, Sheet 256*, Solid and Drift Edition, 1:50,000 series, Ordnance Survey, Southampton.
[38] Cross London Rail Links (August 2011), *Old Oak Common Rolling Stock, Maintenance Depot, Site Remediation Strategy.*

8.3.12 There are no surface water abstractions within 1km of the route.

8.3.13 Further information on surface waters is provided in Section 13 of this report.

Current and historical land use

8.3.14 There are a large number of potentially contaminative land uses, which may have impacted soils or groundwater (at least locally) within the study area.

8.3.15 Historically, between Kilburn and Kensal Green (between grid coordinates C7 and F7 on Map LQ-01-004b), small pockets of potentially contaminative land uses existed, predominantly to the south of the route. Notable industries include garages, engineering works and industrial laundry facilities dating back to the early 20th century.

8.3.16 To the south of the Grand Union Canal by Mitre Bridge, a gasworks existed in the late 19th century (Map LQ-01-005, G7). Further east, Kensal Green Gasworks is located adjacent to the Grand Union Canal (centred on Map LQ-01-005, I7). To the west of Mitre Bridge, the route crosses Old Oak Common sidings which comprised a number of engine sheds and depots. To the west and south-west of Old Oak Common, a number of engineering works and factories were formerly present (these have now been redeveloped as industrial estates located along Telford Way, the A4000 Victoria Road, Portal Way, Chase Road and the B4492 Park Royal Road and are shown on Map LQ-01-005, from C8 in the south to C3 in the north).

8.3.17 Present day potential contamination sources comprise the existing Old Oak Common depot and surrounding commercial and light industrial properties which are present to the south-west, west, north and north-east of the depot. Additionally there are a number of other rail corridors, sidings and depots in the vicinity of the main Old Oak Common depot (Map LQ-01-005, D7), in particular to the north and north-west of Willesden Junction.

8.3.18 Sites that may pose a contaminative risk for the Proposed Scheme (from both historical and current land uses), identified by the assessment, comprise the following (listed from east to west):

- railway land, former printers and garage around the proposed Salusbury Road vent shaft (Map LQ-01-004b, D6 and D7);
- the Old Oak Common rail depot; commercial units to the north of the Grand Union Canal around Hythe Road and the A219 Scrubs Lane, together with the railway land in between (Map LQ-01-005, E6);
- the freightliner terminal and adjoining railway land to the west and south-west of Willesden Junction (Map LQ-01-005, D3); and
- numerous former and current commercial/light industrial land parcels and railway lines to the north-west and west of Old Oak Common including the Victoria Road Industrial Estate (around the Victoria Road crossover box). These

comprise various former manufacturing and commercial uses including engineering works, Acton metal refinery, an abattoir, brickworks and power station (Map LQ-01-005, from C8 in the south to C3 in the north).

8.3.19 It is likely that contamination which may be encountered at the location of the station will be present as a result of historic and current railway activities. At the Old Oak Common depot and sidings, contamination with fuels (mainly diesel) is known to exist[38].

8.3.20 Elsewhere, contaminants associated with the former industries listed above could be present and could include various metals, semi-metals, asbestos, inorganic compounds and organic compounds such as fuels, oils and solvents and ground gases or vapours. Pathogens associated with the former abattoir facility, may also be present beneath this location.

8.3.21 Any contamination sources within this area are all underlain by the low permeability London Clay. The London Clay is known to provide an effective barrier to ground borne contaminant migration and any contamination present is likely to be localised.

Other regulatory data

8.3.22 Regulatory data reviewed include pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences).

8.3.23 A number of these have been recorded in the study area and notable entries are discussed below.

8.3.24 There is one notable regulatory data entry within the study area which the Proposed Scheme will cross, comprising a fuel station entry at Chamberlayne Road (Map LQ-01-005, J5). Additionally a large number of entries are located in the wider study area relating to the various potentially contaminative industries such as the waste transfer stations, industrial estates, and Kensal Green Gasworks.

8.3.25 The entries highlight the current industrial and commercial nature of sections of the study area and include five fuel stations, several pollution prevention control permits for various industries and licences associated with Kensal Green Gasworks.

Mining and mineral areas

8.3.26 There is no record of mining or quarrying activities being undertaken within the study area.

8.3.27 There are no active mining or mineral sites or Preferred Areas (PA) within the study area.

8.3.28 No maps showing any mineral resources areas were available from the minerals planning authority.

Geo-conservation sites

8.3.29 Inspection of supplementary planning guidance issued by London Geodiversity Partnership indicates that there are no current (2013) or potential geological designations (e.g. regionally important geological and geomorphological site(s) (RIGS)/locally important geological site(s) (LIGS) or Geological SSSI's) within the study area.

Receptors

8.3.30 The sensitive receptors that have been identified within this study area are summarised in Table 9.

Table 9: Summary of receptors for land quality effects

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents in existing properties	High
		Rail passengers in Old Oak Common station	High
		Workers, e.g. in factories or existing railway	Medium
	Controlled waters	Grand Union Canal	High
	Built environment	Buildings and property	Low to high
		Underground structures and services	Low

Future baseline

8.3.31 The proposed construction compound located to the north of the proposed Old Oak Common station is currently being used by Crossrail for construction. Previous contamination of this area with free phase hydrocarbons (diesel) is known to have occurred. As part of the Crossrail development, a remediation strategy is being put into place to remove this contamination and thus there will be local improvement in baseline conditions at this site by the time of the construction baseline.

8.3.32 No other developments are known that are judged to impact upon the future baseline in the remainder of the study area.

8.4 Effects arising during construction

Avoidance and mitigation measures

8.4.1 The construction assessment takes into account the mitigation measures contained within the draft CoCP (see Volume 5: Appendix CT-003-000). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. Its requirements in relation to work in contaminated areas will ensure the effective management and control of the work. Such requirements include:

- methods to control noise, waste, dust, odour, gases and vapours (draft CoCP, Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (draft CoCP, Section 5);
- the management of human health exposure, for both construction workers and people living and working nearby (draft CoCP, Section 11);
- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (draft CoCP, Sections 5, 7 and 15);
- management of any unexpected contamination found during construction (draft CoCP, Section 11);
- a post-remediation permit to work system (draft CoCP, Section 11);
- storage requirements for hazardous substances such as oil (draft CoCP, Section 16);
- traffic management to ensure that there is a network of designated haul roads to minimise compaction/degradation of soils (draft CoCP, Section 7); and
- methods to monitor and manage flood risk and other extreme weather events which may affect land quality during construction (draft CoCP, Sections 16).

8.4.2 The draft CoCP requires that a programme of further detailed ground investigation will take place prior to and during construction in order to confirm the full extent of areas of contamination and a risk assessment undertaken to determine what, if any, site specific remediation measures will be required to allow the Proposed Scheme to be constructed safely and to prevent harmful future migration of contaminants (draft CoCP, Section 11). The investigation and assessment of potentially contaminated sites will be undertaken in accordance with:

- Environment Agency CLR11: Model Procedures for the Management of Land Contamination (2004)[39]; and
- British Standard BS10175: Investigation of Potentially Contaminated Sites (2011)[40].

8.4.3 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques. This appraisal will be undertaken based on multi-criteria attribute analysis that considers environmental, resource, social and economic factors in line with Sustainable Remediation Forum UK 'A Framework for Assessing the Sustainability of Soil and Groundwater Remediation'

[39] Environment Agency (2004), *CLR11 Model Procedures for the Management of Land Contamination.*
[40] British Standard (2011), *BS10175 Investigation of Potentially Contaminated Sites.*

(2010)[41]. The preferred option will then be developed into a remediation strategy, in consultation with regulatory authorities prior to implementation.

8.4.4 Contaminated soils excavated from the site, wherever feasible, will be treated as necessary to remove or render any contamination inactive, and re-used within the Proposed Scheme where needed and suitable for use. Techniques are likely to include stabilisation methods, soil washing and bio-remediation to remove oil contaminants. Contaminated soil disposed of off-site will be taken to a soil treatment facility, another construction site (for treatment, as necessary, and re-use) or to an appropriately permitted landfill site.

Assessment of impacts and effects

8.4.5 The majority of the overall Proposed Scheme length within this study area will be located in tunnel at substantial depth within the low permeability London Clay Formation.

8.4.6 The Proposed Scheme includes the excavations into previously developed areas including the construction of the Salusbury Road vent shaft adjacent to the present Queen's Park station, the new Old Oak Common station, the Victoria Road crossover box and the temporary shaft at Victoria Road.

8.4.7 None of the works are expected to extend through the base of the London Clay Formation and into the underlying aquifers.

8.4.8 The new station is proposed on land which currently comprises Old Oak Common sidings. The station is to be of 'closed box' design such that the main body will largely be contained underground and sit between two tunnel portals (east and west facing). See Volume 1, Section 5 for further detail on station design. The route will be at a depth of approximately 15m below the surrounding ground level whilst passing through the station at platform level before descending back closer to 20m below ground level upon exiting to the west.

8.4.9 To the north and north-west of the Old Oak Common station site there will be construction compounds. The Victoria Road crossover box main compound will be used for the construction of the crossover box, shafts and headhouses. The site will be the location of the removal of excavated material from bored tunnels, the receiving site for the sprayed concrete lining materials and tunnel segments from Old Oak Common, as well as logistics support for tunnel fit-out, and base for realignment of roads, bridge reconstruction and utility diversions.

8.4.10 The Willesden Euroterminal main compound, will act as a railhead for receiving material and exporting excavated material, storage for incoming and outgoing materials and a lorry holding area. The compound will be linked to the Atlas Road

[41] Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation.*

satellite compound via an aerial conveyor over the Grand Union Canal. This satellite compound will contain a concrete batching plant to support production of tunnel linings.

Land contamination

8.4.11 In line with the assessment methodology, as set out in the SMR, SMR Addendum and its appendices, an initial screening process was undertaken (identified in the methodology as Stages A and B) to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. In total, 247 areas were considered during this screening process, and of these, 58 areas were taken forward to more detailed risk assessments (Stages C and D), in which the potential risks were assessed more fully. All areas assessed are shown on Maps LQ-01-004b and LQ-01-005; those considered as potentially posing a risk to the Proposed Scheme are also labelled with a reference number.

8.4.12 Conceptual site models (CSM) have been produced for the sites taken through to Stage C and D assessments. The detailed CSM are provided in Volume 5: Appendix LQ-001-004 (Section 3) and the results of the risk assessments are summarised in this section. The 58 potentially contaminated sites have been grouped and considered together, where appropriate. The following factors have determined the need for Stage C and D assessments:

- whether the site is on or off the Proposed Scheme or associated offline works, e.g. roads;
- the vertical route alignment i.e. whether the Proposed Scheme is in cut at the site's location;
- the presence of underlying Principal or Secondary A Aquifers or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

8.4.13 A summary of the baseline CSM is provided in Table 10. The impacts and baseline risks quoted are before any mitigation is applied. The assessed baseline risk is based on the information provided at the time of the assessment. Where limited information has been made available, it is based on precautionary worst case assumptions and may therefore imply a higher risk than that which actually exists.

Table 10: Summary of baseline CSM for sites which may pose contaminative risk for the Proposed Scheme

Area ref[42]	Area name and classification	Main potential impacts[43][44]	Main baseline risk
4-248	Existing on-site railway land located at Old Oak Common sidings known to be impacted by free phase organic substances at shallow depth, overlying London Clay and adjacent to the Grand Union Canal (Map LQ-01-005 in Volume 5, Land Quality Map Book)	Potential impact on human health on-site	Moderate
		Potential exposure of on-site humans to asphyxiative or explosive gases	Moderate/low
		Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds	Low
		Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits	Moderate/low
4-257, 4-260, 4-252, 4-54, 4-265, 4-264, 4-262, 4-263,	Existing on-site railway land overlying the London Clay Formation (Maps LQ-01-004b to LQ-01-005 in Volume 5, Land Quality Map Book)	Potential impact on human health on-site	Moderate/low
		Potential exposure of on-site humans to asphyxiative or explosive gases	Moderate/low
		Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits	Moderate/low
4-82, 4-102, 4-68, 4-139, 4-72, 4-71, 4-140, 4-67, 4-134, 4-133, 4-131, 4-141	Existing on-site trading estates, industrial estates and other current or previous contaminative land uses overlying London Clay (Map LQ-01-005 in Volume 5, Map Book Land Quality)	Potential impact on human health on-site	Low to moderate/low
		Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds	Very low to low
		Potential impact on human health off-site from contaminated dust/particulates	Very low to low
4-55, 4-74, 4-62, 4-53, 4-61, 4-59, 4-124, 4-121, 4-143, 4-73, 4-79, 4-145, 4-70	Existing on-site trading estates, industrial estates and other current or previous contaminative land uses overlying London Clay and adjacent to the Grand Union	Potential impact on human health on-site	Low to moderate
		Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds	Very low to low

[42] Each site is assigned an unique identification number (See Volume 5: Appendix LQ-001-004).
[43] CSM have been prepared as part of the detailed land contamination methodology (refer to Volume 5: Appendix LQ-001-004for baseline, construction and post-construction. Sites have been grouped based on their position relative to the scheme and the presence or absence of groundwater or surface water receptors.
[44] The moderate risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported high or moderate existing baseline risk in the absence of site investigation a precautionary, worst case risk is reported in the table.

Area ref[42]	Area name and classification	Main potential impacts[43][44]	Main baseline risk
	Canal (Map LQ-01-005 in Volume 5, Land Quality Map Book)	Potential impact on Grand Union Canal surface water quality	Very low to low
4-15	Existing/historical contaminative land uses overlying London Clay on the Salusbury Road vent shaft site (Map LQ-01-004b in Volume 5, Land Quality Map Book)	Potential impact on human health on-site	Low
		Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds	Low
		Impact on on-site property receptors	Low
4-16, 4-83, 4-112, 4-100, 4-69, 4-77, 4-116, 4-148, 4-88, 4-149, 4-158, 4-204, 4-205, 4-75, 4-123, 4-03	Existing/historical off-site or adjacent contaminative land uses overlying London Clay (Maps LQ-01-004b and LQ-01-005 in Volume 5, Land Quality Map Book)	Potential impact on human health on-site	Low to moderate/low
		Potential impact on human health off-site from contaminated dust/particulates	Very low to low
		Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits	Very low to moderate/low
4-147, 4-60, 4-81, 4-155, 4-156, 4-180, 4-173	Existing/historical off-site or adjacent contaminative land uses overlying London Clay adjacent to the Grand Union Canal (Map LQ-01-005 in Volume 5, Land Quality Map Book)	Potential impact on human health on-site	Low to moderate/low
		Potential impact on human health off-site from contaminated dust/particulates	Low
		Potential impact on on-site surface water quality	Very low

Temporary effects

8.4.14 An assessment of the effects of contamination has been undertaken by comparing the CSM developed for potential contaminated areas at baseline, construction and post-construction stages. The baseline and construction CSM have been compared to assess effects at the construction stage.

8.4.15 Table 11 presents the summary of the construction effects obtained from a comparison of the baseline and construction impacts. The construction risk assessment takes into account the implementation of the mitigation measures set out within the draft CoCP. The details of these comparisons are presented in Volume 5: Appendix LQ-001-004.

8.4.16 The baseline and construction CSM have been compared to determine the change in level of risk to receptors during the construction stage, and thus to define the level of

effect at the construction stage. Where there is no change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be negligible even if the risk is deemed to be remain as high. This may be the case where the construction of HS2 does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

Table 11: Summary of temporary (construction) effects

Area ref	Area name	Main baseline risk	Main construction Risk[45]	Construction effect - significant?
4-248	Existing on-site railway land located at Old Oak Common Sidings known to be impacted by free phase organic substances at shallow depth, overlying London Clay and adjacent to the Grand Union Canal	Potential impact on human health on-site (moderate risk) Potential exposure of on-site humans to asphyxiative or explosive gases (moderate/low risk) Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (low risk) Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits (moderate/low risk)	Receptors no longer present Receptors no longer present Low Moderate/low	Negligible (not significant)
4-257, 4-260, 4-252, 4-54, 4-265, 4-264, 4-262, 4-263	Existing on-site railway land overlying the London Clay Formation	Potential impact on human health on-site (moderate/low risk) Potential exposure of on-site humans to asphyxiative or explosive gases (moderate/low risk) Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits (moderate/low risk)	Receptors no longer present Receptors no longer present Moderate/low	Negligible (not significant)

[45] The low/moderate main construction risk identified in the above table does not necessarily imply an unacceptable risk. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled.

Area ref	Area name	Main baseline risk	Main construction Risk[45]	Construction effect - significant?
4-82, 4-102, 4-68, 4-139, 4-72, 4-71, 4-140, 4-67, 4-134, 4-133, 4-131, 4-141	Existing on-site trading estates, industrial estates and other current or previous contaminative land uses overlying London Clay	Potential impact on human health on-site (low to moderate/low) Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (very low to low risk) Potential impact on human health off-site from contaminated dust/particulates (very low to low risk)	No longer present Very low to low Very low to low	Negligible (not significant)
4-55, 4-74, 4-62, 4-53, 4-61, 4-59, 4-124, 4-121, 4-143, 4-73, 4-79, 4-145, 4-70	Existing on-site trading estates, industrial estates and other current or previous contaminative land uses overlying London Clay and adjacent to the Grand Union Canal	Potential impact on human health on-site (low to moderate risk) Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (very low to low risk) Potential impact on Grand Union Canal surface water quality (very low to low risk)	No longer present Very low to low Very low to low	Negligible (not significant)
4-15	Existing/historical contaminative land uses overlying London Clay on the Salusbury Road vent shaft site	Potential impact on human health on-site. (low risk) Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (low risk) Impact on on-site property receptors (low risk)	No longer present Low Low	Negligible (not significant)

Area ref	Area name	Main baseline risk	Main construction Risk[45]	Construction effect - significant?
4-16, 4-83, 4-112, 4-100, 4-69, 4-77, 4-116, 4-148, 4-88, 4-149, 4-158, 4-204, 4-205, 4-75, 4-123, 4-03	Existing/historical off-site or adjacent contaminative land uses overlying London Clay	Potential impact on human health on-site (low to moderate/low risk) Potential impact on human health off-site from contaminated dust/particulates (very low to low risk) Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits (very low to moderate/low risk)	Low to moderate/low Very low to low Very low to moderate/low	Negligible (not significant)
4-147, 4-60, 4-81, 4-155, 4-156, 4-180, 4-173	Existing/historical off-site or adjacent contaminative land uses overlying London Clay adjacent to the Grand Union Canal	Potential impact on human health on-site (low to moderate/low risk) Potential impact on human health off-site from contaminated dust/particulates (low risk) Potential impact on on-site surface water quality (very low to low risk)	Low to moderate/low Low Very low to low	Negligible (not significant)

8.4.17 The main construction risk is the risk from the construction of the Proposed Scheme assuming that any mitigation measures as set out in the draft CoCP have been implemented. The temporary effect and significance has been determined by calculating the change in risk between the main baseline risk and the main construction risk. Therefore, where there is no change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be negligible even if the risk is deemed to be high.

8.4.18 Table 11 indicates that based upon the assessment, no temporary significant effects have been identified during the construction phase, in relation to potential land contamination. However, on site risks to human health where historical and current potentially contaminative uses are intersected by the Proposed Scheme have been identified.

8.4.19 Construction site compounds located in this study area will include staff welfare facilities, maintenance facilities for plant and machinery and fuel storage in bunded tanks. Construction compounds will store and use potentially contaminative materials

such as fuels, oils and solvents, and the measures outlined in the draft CoCP will manage risks from the storage of such materials.

8.4.20 The main and satellite compounds may also be used for temporary storage of potentially contaminated soils. The measures outlined in the draft CoCP will manage risks from the storage of such materials.

8.4.21 It is considered unlikely that additional remediation works will be required over and above the mitigation measures contained as standard within the draft CoCP.

8.4.22 There are anticipated to be no significant cumulative temporary effects from construction.

Permanent effects

8.4.23 Baseline and post-construction CSM have been compared to assess the permanent (post-construction) effects. The post-construction CSM assumes that all the required remediation has been carried out and validated.

8.4.24 Table 12 includes a summary of the permanent (post-construction) effects obtained from a comparison of the baseline and post-construction impacts, and whether these are significant. The details of these comparisons are presented in Volume 5: Appendix LQ-001-004.

Table 12: Summary of permanent (post-construction) effects

Area ref	Area name	Main baseline risk	Main post-construction risk	Post-construction effect - significant?
4-248	Existing on-site railway land located at Old Oak Common Sidings known to be impacted by free phase organic substances at shallow depth, overlying London Clay and adjacent to the Grand Union Canal	Potential impact on human health on-site, e.g. rail passengers and station workers within Old Oak Common station (moderate risk)	Very low	Negligible to moderate beneficial effect (significant)
		Potential exposure of on-site humans e.g. rail passengers and station workers within Old Oak Common station to asphyxiative or explosive gases (moderate/low risk)	Low	
		Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (low risk)	Very low	
		Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits (moderate/low risk)	Low	

Area ref	Area name	Main baseline risk	Main post-construction risk	Post-construction effect - significant?
4-257, 4-260, 4-252, 4-54, 4-265, 4-264, 4-262, 4-263	Existing on-site railway land overlying the London Clay Formation	Potential impact on human health on-site (moderate/low risk) Potential exposure of on-site humans to asphyxiative or explosive gases (moderate/low risk) Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits (moderate/low risk)	Very low Low Low	Negligible to moderate beneficial effect (significant)
4-82, 4-102, 4-68, 4-139, 4-72, 4-71, 4-140, 4-67, 4-134, 4-133, 4-131, 4-141	Existing on-site trading estates, industrial estates and other current or previous contaminative land uses overlying London Clay	Potential impact on human health on-site (low to moderate/low) Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (very low to low risk) Potential impact on human health off-site from contaminated dust/particulates (very low to low risk)	Very low Very low Very low	Negligible to moderate beneficial effect (significant)
4-55, 4-74, 4-62, 4-53, 4-61, 4-59, 4-124, 4-121, 4-143, 4-73, 4-79, 4-145, 4-70	Existing on-site trading estates, industrial estates and other current or previous contaminative land uses overlying London Clay and adjacent to the Grand Union Canal	Potential impact on human health on-site (low to moderate risk) Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (very low to low risk) Potential impact on surface water quality (very low to low risk)	Very low Very low Very low	Negligible to moderate beneficial effect (not significant)
4-15	Existing/historical contaminative land uses overlying London Clay on the Salusbury Road vent shaft site	Potential impact on human health on-site (low risk) Potential impact on human health off-site from contaminated vapours and/or volatile organic compounds (low risk) Impact on on-site property receptors (low risk)	Very low Very low Very low	Negligible to minor beneficial effect (not significant)

Area ref	Area name	Main baseline risk	Main post-construction risk	Post-construction effect - significant?
4-16, 4-83, 4-112, 4-100, 4-69, 4-77, 4-116, 4-148, 4-88, 4-149, 4-158, 4-204, 4-205, 4-75, 4-123, 4-03	Existing/historical off-site or adjacent contaminative land uses overlying London Clay	Potential impact on human health on-site (low to moderate/low risk) Potential impact on human health off-site from contaminated dust/particulates (very low to low risk) Migration of hazardous gas and vapours to confined spaces via permeable strata or conduits (very low to moderate/low risk)	Low to moderate/low Very low to low Very low to moderate/low	Negligible (not significant)
4-147, 4-60, 4-81, 4-155, 4-156, 4-180, 4-173	Existing/historical off-site or adjacent contaminative land uses overlying London Clay adjacent to the Grand Union Canal	Potential impact on human health on-site (low to moderate/low risk) Potential impact on human health off-site from contaminated dust/particulates (low risk) Potential impact on on-site surface water quality (very low to low risk)	Low to moderate/low Low Very low to low	Negligible (not significant)

8.4.25 In Table 12, the magnitude of the permanent effects and their significance has been determined by calculating the change in risk between the main baseline risk and the main post-construction risk. Therefore, where there is no change between the main baseline risk and the main post-construction risk, the permanent effect significance is deemed to be negligible even if the risk is deemed to remain above low. This may be the case where the construction of HS2 does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

8.4.26 Table 12 shows that the Proposed Scheme results in either a reduction or no change in the level of risk already existing at each site for both on site and off site receptors.

8.4.27 Table 12 indicates that, following remediation, in most instances there will be overall negligible to minor beneficial effects although in the case of Old Oak Common and immediate surrounding area this will give rise to some moderate (significant beneficial) effects. Depending on the type of remediation undertaken, the beneficial effect for the Old Oak Common will be mostly related to the removal or isolation of contaminants associated with the station box and construction compound construction.

8.4.28 Future station users have been considered in the operational phase risk assessments for the areas identified as posing a contaminative risk and that will include the proposed Old Oak Common station (refer to Table 12 and the CSM presented in Volume 5: Appendix LQ-001-004, Section 3).

8.4.29 The risk assessment for the post-construction stage will include measures that will be adopted in the draft CoCP to remove, treat or isolate contamination. Further measures could also include the construction of permanent embedded design features in buildings, such as gas protection measures (e.g. ventilation of confined spaces or inclusion of gas resistant membranes in basement or floor slabs). Overall risks for future station users from pre-existing contamination sources will be low to very low.

8.4.30 It is therefore considered that there will be no significant impacts to future station users from pre-existing land contamination.

Other mitigation measures

8.4.31 No additional mitigation measures are considered necessary at this stage to mitigate risks from land contamination at construction stage beyond those set out in the draft CoCP and undertaken as part of required remediation strategies.

Summary of likely significant residual effects

8.4.32 With the application of the mitigation measures detailed above, no likely significant adverse residual effects are anticipated.

8.4.33 There are likely to be significant beneficial residual effects associated with the construction and remediation of the footprint of the Old Oak Common station area and former industrial land in proximity of Old Oak Common (around the proposed Victoria Road crossover box).

8.5 Effects arising from operation

8.5.1 Users of the Proposed Scheme (i.e. rail passengers), whilst within trains, are at all routine times, within a controlled environment, and have therefore been scoped out of the assessment.

Avoidance and mitigation measures

8.5.2 Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and best practice whereby appropriate spillage and pollution response procedures will be established.

Assessment of impacts and effects

8.5.3 Auto-transformer stations are proposed to be situated at intervals along the Proposed Scheme. Two auto-transformer stations are proposed to be located in the area, one at the Salusbury Road vent shaft and another next to the Victoria Road crossover box.

8.5.4 An auto-transformer station could, in principle, be a source of potential contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer stations, in common with other modern substations, will use secondary containment appropriate to the level of risk.

8.5.5 The operation of the trains may give rise to minor contamination through leakage of hydraulic or lubricating oils. However, such leakage or spillage is expected to be very small and unlikely to result in significant contamination.

8.5.6 There are no proposed depot areas within the study area.

8.5.7 Overall, there will be no significant operational effects associated with land quality in the study area.

Cumulative effects

8.5.8 It is unlikely that there will be any cumulative effects on land quality of in-combination effects on receptors because of the environmental controls that will be placed on operational procedures.

Other mitigation measures

8.5.9 There may be on-going monitoring requirements following remediation works carried out during construction. Such monitoring, including monitoring of groundwater quality or ground gas, could extend into the operational phase of the Proposed Scheme.

Summary of likely significant residual effects

8.5.10 No significant residual effects are likely to arise from the operation of the Proposed Scheme

9 Landscape and visual assessment

9.1 Introduction

9.1.1 This section reports the assessment of the likely significant landscape and visual effects. It starts by describing the baseline conditions found within and around the route of the Proposed Scheme and goes on to describe the significant effects that will arise during construction and operation on landscape character areas (LCA) and visual receptors.

9.1.2 In this section, the operational assessment section refers not just to the running of the trains but also the presence of the new permanent infrastructure associated with the Proposed Scheme.

9.1.3 Principal landscape and visual issues in the area include:

- temporary effects to LCAs and visual receptors during construction arising from the demolition of buildings, the removal of existing vegetation, the presence of construction plant and aerial conveyors, construction activity, bridge replacements, road widening and traffic and pedestrian diversions; and
- permanent landscape and visual effects during operation arising from the loss of an open space and part of a play area and the presence of new buildings, including vent shaft headhouses up to 11m and the new Old Oak Common station, security fencing up to 2.4m high, security lighting, new bridges, wider roads and hardstanding areas for use during emergency evacuation and maintenance.

9.1.4 A separate but related assessment of effects on the setting of heritage assets is included in Section 6 - Cultural Heritage. Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in the Volume 5: Appendix LV-001-004, which comprises the following parts:

- Part 1 Engagement with technical stakeholders;
- Part 2 Environmental baseline report;
- Part 3 Assessment matrices; and
- Part 4 Schedule of non-significant effects.

9.1.5 The extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages has been discussed with the councils of the CoW, the RBKC, the LBB, the LBE and the LBHF. Summer field surveys, including photographic studies of LCA and visual assessment of viewpoints, were undertaken from May to October 2012 and from May to June 2013. Winter surveys were undertaken from December 2012 to March 2013.

9.2 Scope, assumptions and limitations

9.2.1 The assessment scope, key assumptions and limitations for the cultural heritage assessment are set out in Section 8 of Volume 1, the SMR (Volume 5: Appendix CT-0001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

9.2.2 The study area has been informed by the construction and operational phase zones of theoretical visibility (ZTV), which are shown in on Maps LV-07-006b to LV-07-011-R1 and LV-08-006b to LV-08-011-R1 (Volume 5, Landscape and Visual Assessment Map Book).The ZTV has been produced in line with the methodology described in the SMR Addendum (Volume 5: Appendix CT-0001-000), and is an indication of the theoretical visibility of the Proposed Scheme. In some locations, the lack of data on vegetation cover may mean the actual visibility is substantially less than shown in the ZTV and professional judgement out on site has been used to refine the study area to focus on likely significant effects. Tall construction plant (e.g. cranes and piling rigs) are excluded from the ZTV for the construction phase, but these are described and taken into account in the assessment of effects on landscape character areas and visual receptors.

9.2.3 LCA and visual receptors within approximately 500m of the Proposed Scheme have been assessed. Long distance views of up to approximately 1.8km have been considered at locations such as Kensal Green Cemetery, Wormwood Scrubs and Little Wormwood Scrubs.

Assumptions

9.2.4 Utility works have been assessed on the available information about the scale and duration of excavations. Utilities works will be temporary in nature and are a commonplace occurrence in urban areas. Trees which have amenity value will be retained where possible, in line with the draft CoCP, Section 12, and disturbance minimised. Where vegetation is removed, there will be appropriate replanting. Where the underground services are predicted to be large-scale and will require a minimum of 3m wide by 3m deep trenches, it has been assumed that existing street trees may be affected.

Limitations

9.2.5 During the baseline survey there were some areas which were inaccessible (such as private land, commercial premises and residential buildings). In these instances, views were obtained from PRoW and professional judgment has been used to approximate the likely views from these locations.

9.2.6 Lighting for Old Oak Common station will be set out during detailed designed and the effects of operational lighting for the station have not been assessed at this stage. Other lighting will be typical of operational facilities with low level, task orientated lighting.

9.3 Environmental baseline

Existing baseline

Landscape baseline

9.3.1 The area lies in the densely developed urban environment of west London. Land uses are predominantly 19th and 20th century housing in the eastern part of the Kilburn (Brent) to Old Oak Common area and large scale industrial and commercial estates in the west. Open spaces include Queen's Park, Wormwood Scrubs, Little Wormwood Scrubs, Kensal Green Cemetery, St. Mary's Roman Catholic Cemetery and Acton Cemetery. The landform generally rises towards the north and west, with a steeper (5m) change in level west of the Old Oak Common depot. The area is crossed by transport routes including the Grand Union Canal, railway lines and roads in cuttings, on bridges, viaducts and embankments. A canal towpath follows the Grand Union Canal along the northern edge of the Old Oak Common depot.

9.3.2 The LCA have been determined with reference to the London Regional Landscape Framework[46].

9.3.3 Descriptions of all LCA are provided in Volume 5: Appendix LV-001-004, Section 2. For the purposes of this assessment the study area has been sub-divided into 13 discrete LCA, three of which are most likely to be affected. A description of the baseline character of the LCA is provided below. The LCA are shown on Maps LV-02-006b to LV-02-011-R1 (Volume 5, Landscape and Visual Assessment Map Book).

Kilburn Lane and Carlton Vale Post-war Residential and Community LCA

9.3.4 Much of the western end of the LCA has been redeveloped since 1945, with residential tower blocks and lower apartment blocks, set in communal open space. There are 19th century buildings and terraced housing of architectural interest in the South Kilburn Conservation Area[47], in the eastern part of the LCA. The eastern end of the B413 Kilburn Lane is a busy high street with independent shops at ground floor level and flats above. The pavements are cluttered with litter bins, signs, bollards, ticket machines and traffic lights. The car park at the southern end of the B414 Salusbury Road, the B413 Kilburn Lane and Carlton Vale contains a public toilet, two trees growing in sparse shrub planting and advertising hoardings. The overall landscape condition is fair. The high street character is weakened at the junction of the B413 Kilburn Lane and the B414 Salusbury Road with a one-way gyratory system around Cullen House and the Falcon public house. This is an important transport node in the LCA. The railway corridor north of the Salusbury Road vent shaft site limits road and pedestrian movement north-south in the wider area and the resulting high level of traffic using the B414 Salusbury Road bridge contributes to the low tranquillity of the

[46] Natural England (2011), *London Regional Landscape Framework*.
[47] Brent Council (1979), *South Kilburn Conservation Area: Character Appraisal*.

LCA. Due to the presence of busy roads and the mixed quality and style of development in the LCA, the overall landscape is of local value. Therefore, this area has a medium sensitivity to change.

Old Oak Common Residential LCA

9.3.5 Housing in this area is surrounded by railway lines, roads and industrial development. Wells House Road, west of the Old Oak Common depot and Old Oak Common Lane, is a triangular shaped, Edwardian development of two and three storey houses. The London Overground and Cricklewood to Acton Wells Line pass on the western side of Wells House Road. The London Underground Central line and the Acton and Northolt Line run through a triangular shaped area of railway land to the south. This has become vegetated with self-sown trees, shrubs and grasses. Shaftesbury Gardens, a development of three and four storey flats of modern construction and Midland Terrace, an Edwardian terrace, are also west of the depot, but separated from it by Old Oak Common Lane and the London Overground. Shaftesbury Gardens is set in a communal landscape with specimen trees, ornamental shrubs and lawns. There are three tree-lined and fenced open spaces on Victoria Road, one containing play equipment. The housing areas are relatively well maintained and the landscape condition is fair. There is no through traffic in the residential streets in the LCA and consequently they have a secluded character, but the close proximity of the depot and the presence of major road and rail infrastructure mean that tranquillity in the LCA is low. Due to busy roads and the mixed quality and style of development in the LCA, the overall landscape is of local value. However, despite the fair condition and low tranquillity of the area, its residential nature and secluded character means that this area has a medium sensitivity to change.

Wormwood Scrubs Open Space LCA

9.3.6 Wormwood Scrubs, on the southern boundary of Old Oak Common depot, is the largest open space in the area (65ha) and is designated as metropolitan open land. The remnant of Old Oak Common, in the north-west corner of the park, is registered common land. The open space includes trees, woodland planting, wildflower meadows and areas of short grass for sports and recreational activities. Gantries, overhead lines, train sheds, lighting columns and other infrastructure elements in the depot are visible over the partially wooded embankment on the boundary between the depot and the open space. Wormwood Scrubs has an extensive, open feel, with long views looking east towards the City. Planting around its western end gives it a sense of seclusion, despite the close proximity of the surrounding transport infrastructure. Little Wormwood Scrubs (9ha) is a smaller space to the south-east of the depot. It feels enclosed with housing on two sides and a railway embankment on its north side, separating the space from the North Pole depot and the GWML tracks. It has the character of an urban park, with play areas, exercise trails and ornamental planting. The landscape condition of the LCA is fair. Overall, due to the presence of roads, railway lines and the busy depot, tranquillity is medium. The two open spaces

largely serve the local community, but due to the MOL status of Wormwood Scrubs the LCA is of borough value. Overall, this area has a high sensitivity to change.

Visual baseline

9.3.7 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-004 Part 2. A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are shown on Maps LV-03-006b to LV-03-011-R1 and LV-04-006b to LV-04-011-R1 (Volume 2, CFA4 Map Book).

9.3.8 The viewpoints are numbered to identify their locations which are shown on Maps LV-03-006b to LV-03-011-R1 (Volume 2, CFA4 Map Book). In each case, the middle number (xxx.x.xxx) identifies the type of receptor that is present within the study area - 2: Residential, 3: Recreational, 4: Transport.

9.3.9 No protected views have been identified within the study area, though the conservation area appraisal for St. Mary's Roman Catholic Cemetery[48] confirms the need to protect important views from the cemetery.

9.3.10 Residential receptors have a high sensitivity to change and are located around the B414 Salusbury Road, Portnall Road, the B413 Kilburn Lane and Claremont Road and around the Old Oak Common depot in Wells House Road, the A4000 Victoria Road, Midland Terrace, Shaftesbury Gardens and Old Oak Lane. Existing views across the urban area typically include housing, industrial sites and railway or other transport infrastructure.

9.3.11 Recreational receptors also have a high sensitivity to change and include users of Wormwood Scrubs open space, the play area and open space in Victoria Road, the tow-path of the Grand Union Canal and Acton Cemetery. Existing views are of trees and open space in the foreground but also include elements of the urban environment such as housing, industrial sites and railway and other transport infrastructure.

9.3.12 People at work, attending educational instructions, engaged in formal sports and people passing through the area have a low sensitivity to change. They are generally located in and around Wormwood Scrubs and Victoria Road. Existing views are urban in character and typically include elements such as housing, industrial sites and railway and other transport infrastructure.

Future baseline

9.3.13 A summary of the committed developments which are assumed to be built and occupied prior to either the construction or operation of the Proposed Scheme is provided below, along with the consequential effect on the character of LCAs and nature of views. Developments which would introduce new visual receptors which

[48] Hammersmith and Fulham, (1998), *St. Mary's Conservation Area Character Profile.*

may be significantly affected are also described. These developments are shown on Maps CT-13-004b to CT-13-005 (Volume 5, Cross Topic Appendix 1 Map Book).

Construction (2017)

9.3.14 It is assumed that a number of mixed use and residential developments within the study area will be built and occupied by 2017. They include a development at the junction of Carlton Vale and Kilburn Park Road, a redevelopment at 182 Carlton Vale, 58 Peel Precinct and the garages to the east, the redevelopment of the British Legion Hall on the corner of the Carlton Vale/Salusbury Road roundabout, the redevelopment of Wood House on Albert Road, Bond House on Rupert Road, Hicks Bolton House on Denmark Road and of 1-2 Denmark Road and the redevelopment at the junction of Chase Road and the A4000 Victoria Road. These developments would alter the character of parts of existing LCA but since they would mainly replace buildings of similar scale, type and use, they would be characteristic of their setting. The new developments would generally result in enhancement of their immediate surroundings, but overall there would be no change to the overall sensitivity of LCA.

9.3.15 The committed developments will largely replace existing similar developments or will be in an area where visual receptors have been already been identified and included in this assessment. Therefore these developments will not introduce new visual receptors.

Operation (2026)

9.3.16 The redevelopment of Nash House on Old Oak Lane and the redevelopment of the Westwood Business Centre at Victoria Road will take place after 2026 because both these sites will be used as construction sites by the Proposed Scheme. These developments will alter the character of parts of the existing LCA but since they will mainly replace buildings of similar scale, type and use, they would be characteristic of their setting. The new developments will generally result in enhancement of their immediate surroundings, but overall there would be no change to the overall sensitivity of the LCA.

9.3.17 The developments will largely replace existing similar developments or will be in an area where visual receptors have been already been identified and included in this assessment. Therefore these developments will not introduce new visual receptors.

9.4 Temporary effects arising during construction

9.4.1 The construction works which may give rise to significant effects on landscape and visual receptors includes:

- construction of the vent shaft, headhouse and auto-transformer station at Salusbury Road and traffic and footpath diversions;
- construction of the new Old Oak Common station at Old Oak Common depot;

- replacement of the rail bridges over Old Oak Common Lane and the London Underground Central line;
- widening and lowering of Old Oak Common Lane and construction of an access to the North Pole depot;
- construction of a foot/cycle bridge east of the Victoria Road bridge over the London Underground Central line;
- widening of the A4000 Victoria Road and construction of two new underpasses for pedestrians and cyclists under the Cricklewood to Acton Wells Line;
- widening of the A4000 Victoria Road, Old Oak Common Lane, Old Oak Lane and Atlas Road junction;
- construction of a crossover box and headhouses between Victoria Road, Chase Road, School Road and the London Underground Central line;
- demolition of buildings on the Salusbury Road vent shaft main construction compound, at Old Oak Common depot, Atlas Road, the A4000 Victoria Road, south of School Road and south of Wells House Road;
- removal of existing vegetation on along the Proposed Scheme including at Wormwood Scrubs, on railway land south of Wells House Road and in Victoria Road;
- use of land at Old Oak Common depot, Atlas Road, east and west of the A4000 Victoria Road, south of Wells House Road and on the Willesden Euroterminal site for construction;
- use of aerial conveyors to remove excavated material and move materials between compounds and the depot over the Grand Union Canal; and
- presence of construction plant and construction activity.

Avoidance and mitigation measures

9.4.2 As is commonplace with major infrastructure works, the scale of the construction activities means that works will be visible in many locations and will have the potential to give rise to significant temporary effects which cannot be mitigated practicably. Such effects are temporary and vary over the construction period depending on the intensity and scale of the works at the time.

9.4.3 The assessment of landscape and visual effects has been based on the activities occurring during the peak construction phase, which is defined as the period during which the main civil engineering works will take place, including establishment of compounds, tunnelling, and works at vent shafts and Old Oak Common station. The effects associated with the peak construction phase in this CFA will generally be considered to be long term given the construction programme (see Section 2.3).

9.4.4 Overall, civil engineering works in this study area will be undertaken between the start of 2017 and the middle of 2025. The majority of the main and satellite compounds will be in place for between approximately three and five years, with the exception of the Old Oak Common station main compound which will be in place for approximately

eight and a half years during the civil engineering works phase. Effects during other phases of works are likely to be lesser due to less construction equipment being required at the time and a reduced intensity of construction activity.

9.4.5 Measures that have been incorporated into the draft CoCP to avoid or reduce landscape and visual effects during construction include following (see Volume 5: Appendix CT-003-000):

- maximising the retention and protection of existing trees and vegetation (draft CoCP, Section 12);
- use of well-maintained hoardings and fencing (draft CoCP, Section 5); and
- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses (draft CoCP, Section 5).

9.4.6 These measures have been taken account of in the assessment of the construction effects as follows.

Assessment of temporary impacts and effects

9.4.7 The most apparent changes to landscape character and views during construction will relate to the presence of construction plant, compounds and aerial conveyors and the demolition of buildings. Changes will also arise from the construction of the Salusbury Road vent shaft, the new Old Oak Common station, the Victoria Road crossover box and the replacement or widening of roads and bridges. Vegetation will be removed from railway land, the western end of Wormwood Scrubs around the access to the North Pole depot and from open spaces on the A4000 Victoria Road. The dense urban development and existing vegetation, especially in the area around the B414 Salusbury Road, will screen much of the construction activity from the wider area. However, the height of the construction plant and the large scale of the works will result in significant visual effects during construction on LCA and visual receptors in close proximity to construction

9.4.8 Utility works will be temporary in nature and are a common occurrence in urban areas. Trees which have amenity value will be retained where possible, in line with the draft CoCP (Section 12), and disturbance minimised. Where vegetation is removed, there will be appropriate replanting and no significant effects are anticipated.

Landscape assessment

9.4.9 The following section describes the likely significant effects on LCA during construction. All LCA within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-004, Part 4.

Kilburn Lane and Carlton Vale Post-war residential and community LCA

9.4.10 The Proposed Scheme will include the removal of two medium sized trees and a shrub bed, the demolition of existing buildings and construction of the vent shaft headhouse and auto-transformer station on a site south of the existing railway line and west of Premier Corner (in this LCA). The Salusbury Road vent shaft main compound will be surrounded by 2.4m high hoardings and will also occupy one side of Claremont Road and part of Premier Corner. The existing buildings on the site to be demolished are of little architectural interest and do not positively contribute to the overall quality of the LCA.

9.4.11 The hoardings, the presence of cranes, construction traffic and activity will introduce large scale and prominent new elements into the LCA, altering the setting of the character area.

9.4.12 Construction traffic will use the B414 Salusbury Road (south of the railway bridge), Carlton Vale and the B413 Kilburn Lane; activity from the construction vehicles and activity on site will reduce tranquillity in the LCA.

9.4.13 Impacts will be most intense in close proximity to the works but they will diminish across the wider LCA due to the density of the surrounding urban development. Overall, the magnitude of change will be medium.

9.4.14 The medium magnitude of change, combined with the medium sensitivity of the character area, will result in a moderate adverse effect.

Old Oak Common residential LCA

9.4.15 Most construction activity will occur very close to, but outside, this LCA. There will be large scale works in the Old Oak Common depot, on Old Oak Common Lane, on Old Oak Lane, on the A4000 Victoria Road and on land in railway or industrial use south and west of Wells House Road. Mature trees growing immediately west of the bridge under the Cricklewood to Acton Wells Line and in the open spaces along the A4000 Victoria Road will also be removed to widen the road under the bridge and to accommodate an aerial conveyor. The play area and two other open spaces on Victoria Road will be closed.

9.4.16 The removal of trees and vegetation and the closure of the play area and open spaces will result in the loss of key characteristics of the character area. The presence of the aerial conveyors and of construction traffic and activity will introduce large scale and prominent new features into the LCA, altering the characteristics of the character area.

9.4.17 Construction traffic will use Old Oak Common Lane, Old Oak Lane and the A4000 Victoria Road. Increased traffic on Old Oak Common Lane and the A4000 Victoria Road will also contribute to a reduction in tranquillity.

9.4.18 Overall, the magnitude of change will be medium.

9.4.19 The medium magnitude of change, combined with the medium sensitivity of the character area, will result in a moderate adverse effect.

Wormwood Scrubs open space LCA

9.4.20 Construction activity will be focussed on Old Oak Common Lane where demolition of bridges and excavation works associated with the widening and lowering of the road will introduce new features into the landscape. Works associated with the alteration of the access road to the North Pole depot and Old Oak Common station will also involve demolitions in the depot area, excavation and track laying in the railway corridor. Trees and shrubs will also be removed from the embankment close to the access road to the North Pole depot.

9.4.21 The removal of vegetation will result in a loss of a key characteristic of the character area. The presence of construction works and construction plant which will, due to their large scale, introduce prominent, though temporary, new features into the LCA, affecting the setting of the character area.

9.4.22 Construction will increase traffic on Old Oak Common Lane. Much of the construction will be focussed within the Old Oak Common depot which already experiences high levels of activity. Except for a slight reduction on tranquillity at the western end of Wormwood Scrubs, overall tranquillity in the LCA will not be noticeably reduced. The depot and surrounding extensive transport infrastructure currently detract from the character of the LCA. Impacts will be most intense in close proximity to the works but they will diminish over the wider LCA due to the screening effects of intervening vegetation and the embankment along the northern side of Wormwood Scrubs. Overall, the magnitude of change will be medium.

9.4.23 The medium magnitude of change, combined with the high sensitivity of the character area, will result in a moderate adverse effect.

Visual assessment

9.4.24 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken during winter, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities might be reduced during summer when vegetation, if present in a view, will be in leaf. Where residential receptors experience significant effects at night-time arising from additional lighting, these are also presented in this section. Representative viewpoints within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-004, Part 4.

9.4.25 The number identifies the viewpoint locations which are shown on Maps LV-07-006b to LV-07-011 (Volume 5, Landscape and Visual Assessment Map Book). In each case, the middle number (xxx.x.xxx) identifies the type of receptor present in the area - 2: Residential, 3: Recreational, 4: Transport.

9.4.26 Where a viewpoint may represent multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity may be lower than those reported.

Viewpoints 013.2.001: View west from Salusbury Road/Albert Road junction and 013.2.002: View north from Kilburn Lane

9.4.27 The demolition of the existing buildings on the site and the construction of the Salusbury Road vent shaft, the headhouse building and the auto-transformer station will be clearly visible in the middle ground of the view over Premier Corner from dwellings a minimum of 23m away. Construction activity at ground level will be screened by 2.4m high hoardings. Although the clutter of signage and street furniture along the road are detracting elements in the view, the large scale of the works and the presence of hoardings, construction activity and cranes will result in the introduction of prominent new features in the view a short distance away.
The magnitude of change is considered to be high.

9.4.28 The high magnitude of change, combined with the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoints 013.4.003: View east from Kilburn Lane, 013.4.004: View north from Portnall Road and 014.4.001: View south from Salusbury Road

9.4.29 The demolition of the existing buildings and the construction works associated with the Salusbury Road vent shaft, the headhouse building and the auto-transformer station will be clearly visible in these views. Although the existing views include detracting elements (e.g. advertising hoardings, light industrial unit and car park) the large scale of the works and the presence of 2.4m high hoardings, construction activity and cranes will result in the introduction of new features into the view a short distance from receptors. The magnitude of change is considered to be medium.

9.4.30 The medium magnitude of change, combined with the medium sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 014.2.002: View east from dwellings on Claremont Road

9.4.31 The demolition of the existing buildings on the site and the works to construct the Salusbury Road vent shaft, the headhouse building and the auto-transformer station will be clearly visible in the foreground of the view. Part of Claremont Road will be included in the construction site and the construction boundary will be approximately 8m away from the viewpoint. Although the neglected appearance of the vacant building and the boundary fencing are detracting elements in the view, the large scale of the works and the presence of hoardings, construction activity and cranes will result in a major alteration to the view, a short distance away. The magnitude of change is considered to be high.

9.4.32 The high magnitude of change, combined with the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 017.3.009: view north-west from Wormwood Scrubs open space

9.4.33 A number of construction activities will be visible in the background of the view, over the open space in the foreground and the vegetation growing on the northern boundary of Wormwood Scrubs beyond. These will include the demolition of buildings, the removal of vegetation, construction of the station, the widening and lowering of Old Oak Common Lane, the replacement of bridges and alterations to the access road to the North Pole depot. Construction activity at ground level will be partly screened by hoardings and vegetation. However, the presence of hoardings and cranes and the large scale of the works will introduce new features in the view. The magnitude of change is considered to be medium.

9.4.34 There will be noticeable deterioration in the existing view; the medium magnitude of change, combined with the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 019.2.002: Views east, west and south from dwellings on Wells House Road

9.4.35 The demolition of buildings, the removal of vegetation, the construction of the station and crossover box, the widening and lowering of Old Oak Common Lane, the replacement of bridges and the presence of worksites will be partly screened by garden fences and vegetation in the foreground from a minimum of 5m away. There will be clear views down onto the construction works on Old Oak Common Lane and in the depot from upper floor windows. At street level, construction activity will be screened by 2.4m high hoardings, but cranes and other construction plant will be clearly visible above. Although, the industrial sheds, depot buildings and existing transport infrastructure currently detract from the view, the large scale of the construction works will be highly visible a short distance away. The removal of vegetation on the land south of Wells House Road will open up views of the construction site. The magnitude of change is considered to be high.

9.4.36 The high magnitude of change, combined with the high sensitivity of the receptor, will result in a major adverse effect.

9.4.37 At night, the use of additional lighting associated with the main and satellite construction compounds associated with the Old Oak Common and North Pole depots will be viewed in the context of the existing street and depot lighting. Effects at night are considered not significant and are reported in Volume 5: Appendix LV001-004, Part 4.

Viewpoint 019.2.004: Views north and east from tower blocks on Victoria Road, the University of Arts London and the Holiday Inn Express London Park Royal

9.4.38 The construction of the Victoria Road crossover box and bridge widening will be clearly visible from higher floors of the tower blocks and the hotel. Views from ground

floor windows will be partly screened by North Acton London Underground station, boundary fencing and embankment vegetation in the middle ground of the view, but cranes and other construction plant will be visible above in the background. The vegetation growing on the northern railway embankments will be removed, further opening up views of the large crossover box construction site. Although, the industrial sheds on the crossover box site and the station and railway lines currently detract from the view, the presence of cranes and the large scale of the works will introduce prominent new features in to the view. The magnitude of change is considered to be medium.

9.4.39 There will be noticeable deterioration in the existing view; the medium magnitude of change, combined with the high sensitivity of the receptor, will result in a moderate adverse effect.

9.4.40 At night, the use of additional lighting associated with the Victoria Road tunnel drive main compound and the Victoria Road crossover box main compound will be viewed in the context of the existing street lighting and light spill from adjacent buildings. Effects at night are considered not significant and are reported in Volume 5: Appendix LV001-004, Part 4.

Viewpoint 020.3.005: View north-west from the Grand Union Canal towpath

9.4.41 The aerial conveyors and temporary bridge crossing over the Grand Union Canal will be clearly visible in the foreground above the Grand Union Canal towpath. Views of construction activity at ground level on the Atlas Road satellite compound and the Willesden Euroterminal main compound will be partly screened by hoardings and existing boundary vegetation. The aerial conveyors and bridge will be visible in close proximity to receptors but in the context of the existing industrial uses on the Atlas Road satellite compound and the Willesden Euroterminal main compound which detract from the view. The magnitude of change is considered to be medium. There will be noticeable deterioration in the existing view.

9.4.42 The medium magnitude of change, combined with the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 020.2.009: View west from Midland Terrace and Shaftesbury Gardens

9.4.43 The works to widen the A4000 Victoria Road under the railway bridge will be clearly visible from Shaftesbury Gardens and in oblique views from Midland Terrace. The three areas of open space, including the play area, will be used as construction sites and all the trees will be removed, opening up currently filtered views of Victoria Road, the railway bridge and the buildings beyond. The Victoria Road vent shaft main compound will be visible over the Cricklewood and Acton Junction Line and filtered through intervening vegetation in back gardens and the railway corridor from Midland

Terrace. Construction activity and plant will be new features in the view in close proximity to receptors. Therefore, the magnitude of change is considered to be high.

9.4.44 The high magnitude of change, combined with the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 020.2.010: View west and north from Old Oak Lane

9.4.45 The demolition of Rowan House and Nash House and the road widening at the junction of the A4000 Victoria Road, Old Oak Common Lane, Old Oak Lane and Atlas Road will be clearly visible from the houses in Old Oak Lane overlooking the junction. A line of deciduous and evergreen trees will be removed, opening up views of the Atlas Road satellite compound which will be situated on the land occupied by Nash House opposite. The hoardings, construction activity and cranes will be new features in the view a short distance away. However, these will be viewed in the context of existing detracting features such as the derelict Nash House and therefore the magnitude of change is considered to be medium. There will be noticeable deterioration in the existing view.

9.4.46 The medium magnitude of change, combined with the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 022.3.001: View east from Acton Cemetery

The demolitions of the existing industrial buildings on the Victoria Road crossover box main compound between the A4000 Victoria Road and Chase Road, the construction of the crossover box 30m below ground level, and the above ground headhouses will be clearly visible in the middle ground of the view from the cemetery over the A4000 Victoria Road. The construction works and the presence of hoardings, construction activity and cranes will introduce new features into the view a short distance away from receptors, but they will be seen in the context of the busy road and the existing industrial and commercial uses on the site. The magnitude of change is considered to be medium. There will be noticeable deterioration in the existing view.

9.4.47 The medium magnitude of change, combined with the high sensitivity of the receptor, will result in a moderate adverse effect.

Cumulative effects

9.4.48 Section 2.1 and Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the construction of the Proposed Scheme. The consequential cumulative effect of these developments on LCAs and viewpoints is described below. These developments are shown on Maps CT-13-004b to CT-13-005 (Volume 5, Cross Topic Appendix 1 Map Book).

9.4.49 No committed developments have been identified that will be under construction at the same time as the Proposed Scheme and no cumulative effects have therefore been considered.

Other mitigation measures

9.4.50 No other mitigation measures are considered practicable during construction.

Summary of likely significant residual effects

9.4.51 These effects will be temporary and reversible in nature lasting only for the duration of the construction works. Any residual effects will generally arise from the widespread presence of construction activity and construction plant within the landscape and viewed from surrounding residential receptors, and users of main roads within the study area.

9.5 Permanent effects arising during operation

9.5.1 The specific elements of the Proposed Scheme that have been taken into account in determining the effects on landscape and visual receptors are listed as follows:

- the Salusbury Road vent shaft headhouse, approximately 43m by 19m and approximately 9.5m above ground level, and the auto-transformer station, approximately 33m by 16m and 5m above ground level, at Salusbury Road. Hardstanding will be provided on the site of the existing Salusbury Road car park and security fencing 2.4m high will extend around the perimeter of the compound;
- the new Old Oak Common station building, approximately 25m above ground level, with platforms, passenger and staff facilities and plant rooms below ground level, ventilation towers and escape stairs. The footprint dimensions of the HS2 part of Old Oak Common station will be approximately 900m long by 70m wide. The connecting bridge to the GWML station will be approximately 120m long by 30m wide and the GWML station will be approximately 320m long by 70m wide;
- creation of new wetland at Wormwood Scrubs;
- the widening and lowering of Old Oak Common Lane and the new road junctions leading to the station;
- a new access road off Old Oak Common Lane leading to substations south of Wells House Road;
- the widening of the A4000 Victoria Road and the two new underpasses under the Cricklewood and Acton Wells Line bridge over Victoria Road and the loss of trees and part of the open spaces on Victoria Road;
- the reconfigured junction of the A4000 Victoria Road, Old Oak Common Lane, Old Oak Lane and Atlas Road and the loss of planting along Old Oak Lane; and

- the two headhouse buildings over the Victoria Road crossover box, 11m above ground level. One headhouse will be near the School Road/the A4000 Victoria Road junction and the second east of Chase Road, opposite Acton Cemetery.

Avoidance and mitigation measures

9.5.2 The operational assessment of impacts and effects is based on 2026 (year 1), year 15 (2041) and year 60 (2086) of the Proposed Scheme. A process of iterative design and assessment has been employed to avoid or reduce adverse effects during the operation of the Proposed Scheme. Measures that have been incorporated into the design of the Proposed Scheme include:

- woodland planting to replace trees and shrubs removed from Wormwood Scrubs (around the new access road to the North Pole depot), from railway land south of Wells House Road and from the railway embankment between the ANL corridor and the Victoria Road crossover box site and Acton Cemetery;
- tree planting in the open spaces on Victoria Road, along the boundary between Old Oak Common station and Old Oak Common Lane and along the new access roads into the station;
- restoration of the grass areas in the open spaces on Victoria Road and grass seeding on the vacant land adjacent to the new access road to Old Oak Common station; and
- restoration of the area used for construction at Atlas Road, Victoria Road, School Road, Bethune Road and on the Willesden Euroterminal sites.

9.5.3 These measures have been taken account of in the assessment of the operational effects below.

Assessment of impacts and effects

9.5.4 The significant effects on the landscape character and visual receptors in operation will arise from the presence of the tunnel shaft and auto-transformer station buildings, the areas of hardstanding and the security fencing at Salusbury Road and from the new buildings and public realm at Old Oak Common station. There will also be a loss of public open space, including part of the play area on the A4000 Victoria Road, and a loss of trees and other vegetation along Victoria Road and Old Oak Lane and from the railway land south of Wells House Road. However, views from all but the areas immediately overlooking the Proposed Scheme will be limited by the dense urban development of the study area.

Landscape assessment

9.5.5 This section describes the significant effects on LCA during 2026 (year 1), year 15 and year 60 of operation. Non-significant effects on LCA are presented in Volume 5: Appendix LV-001-004, Part 4. The assessment of effects in year 15 assumes proposed planting has grown by approximately 450mm a year (i.e. trees will be 7-7.5m high).

The assessment of effects in year 60 assumes all planting has reached its fully mature height.

Kilburn Lane and Carlton Vale post-war residential LCA

9.5.6 The Salusbury Road vent shaft site is surrounded by buildings of four storeys and more which will effectively screen the Proposed Scheme from the wider area, beyond the immediate surroundings of the site. The vent shaft headhouse and auto-transformer station will replace existing buildings on the site but will occupy a much larger area of the site. The headhouse building will be set back from the B413 Kilburn Lane by 20m but will come within 1.5 m of the footpath at its south eastern corner (the current building on the site is 10m from the B413 Kilburn Lane and a minimum of 6.5m from the footpath). The auto-transformer station will be similarly close to the footpath. Security fencing will run along the back of the footpath around most of the headhouse site. The landscape effects of the Proposed Scheme will include:

- the Salusbury Road vent shaft headhouse and the auto-transformer station will be far more substantial structures than the existing buildings on the site. The location of the headhouse building only 1.5m from the footpath at its south-eastern corner will enhance this feeling of scale. The headhouse have a largely blank façade, broken by ventilation louvers and doors; it will lack the diversity of the building forms currently on the site. The auto-transformer station will be a wholly utilitarian structure without boundary walls or a roof. The Proposed Scheme will therefore introduce prominent new elements into the LCA; and
- the security fencing, approximately 2.4m high and running along the site boundary, will be a prominent new element in the character area.

9.5.7 The existing site is in use as a public car park and one of the buildings is in daily use. Therefore the use of the site in operation for maintenance and occasional emergency evacuation is unlikely to increase activity on the site above current levels.

9.5.8 Overall, due to the addition of prominent new elements within the character area, the magnitude of change is considered to be high in year 1 of operation.

9.5.9 The high magnitude of change, combined with the medium sensitivity of the character area, will result a moderate adverse effect.

9.5.10 No planting has been proposed for the Salusbury Road vent shaft site and hence operational effects will remain unchanged in years 15 and 60.

Visual assessment

9.5.11 This section describes the significant effects on visual receptors during year 1, year 15 and year 60 of operation. Non-significant effects on visual receptors are presented in Volume 5: Appendix LV-001-004, Part 4.

9.5.12 For each viewpoint the following assessments have been undertaken:

- effects during winter of year 1 of operation;
- effects during summer of year 1 of operation;
- effects during summer of year 15 of operation; and
- effects during summer of year 60 of operation.

9.5.13 No significant effects at night-time arising from additional lighting have been identified.

9.5.14 The number identifies the viewpoint locations which are shown on Maps LV-04-006b to LV-04-011-R1 (Volume 2, CFA4 Map Book). In each case, the middle number (xxx.x.xxx) identifies the type of receptor present in the area - 2: Residential, 3: Recreational, 4: Transport.

9.5.15 Where a viewpoint may represent multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity may be lower than those reported.

Viewpoints 013.2.001: View west from Salusbury Road/Albert Road junction and 013.2.002: View north from Kilburn Lane

9.5.16 The large scale of the proposed vent shaft headhouse and auto-transformer station means that they will occupy a larger proportion of the view and will be visually more dominant than the existing buildings on the site. The headhouse building will have largely blank façades, only broken by ventilation louvers and doors and will lack the diversity of the building forms currently on the site, though these buildings are of limited architectural interest. The auto-transformer station will be an industrial structure and will appear incompatible in an urban environment. Both structures and the security fencing along the back of the footpath will be prominent in the view, in close proximity to receptors. The Proposed Scheme will result in a major alteration to the view. Overall, the magnitude of change is considered to be high.

9.5.17 The view of the proposed development from viewpoint 013-2-001 during operation is illustrated on the photomontage shown in Figure LV-01-019 (Volume 2, CFA4 Map Book).

9.5.18 No planting is been proposed for the vent shaft site and hence the view will be the same in summer and winter.

9.5.19 The high magnitude of change, combined with the high sensitivity of the receptor, will result in a major adverse effect in year 1 of operation.

9.5.20 As no planting has been proposed, operational effects will remain unchanged in year 15 and year 60 when compared to year 1.

Viewpoints 013.4.003: View east from Kilburn Lane, 013.4.004: View north from Portnall Road and 014.4.001: View south from Salusbury Road

9.5.21 The large scale of the proposed Salusbury Road vent shaft headhouse and auto-transformer station means that they will occupy a larger proportion of the view and will be visually more dominant than the existing buildings on the site. The headhouse building will have largely blank façades, only broken by ventilation louvers and doors and will lack the diversity of the building forms currently on the site, though these buildings are of limited architectural interest. The auto-transformer station will be an industrial structure and will appear incompatible in an urban environment. The close proximity of the Proposed Scheme to people walking through the area and the presence of security fencing along the back of the footpath will result in a major alteration to the view. Overall, the magnitude of change is considered to be high.

9.5.22 The view of the proposed development from this viewpoint 014-4-01 during operation is illustrated on the photomontage shown in Figure LV-01-020 (Volume 2, CFA4 Map Book).

9.5.23 No planting has been proposed for the vent shaft site and hence the view will be the same in summer and winter.

9.5.24 The high magnitude of change, combined with the high sensitivity of the receptor, will result in a major adverse effect in year 1 of operation.

9.5.25 As no planting has been proposed, operational effects will remain unchanged in year 15 and year 60 when compared to year 1.

Viewpoint 014.2.002: View east from Claremont Road

9.5.26 The large scale of the proposed Salusbury Road vent shaft headhouse and auto-transformer station means that they will occupy a larger proportion of the view and will be visually more dominant than the existing buildings on the site. The headhouse building will have largely blank façades, only broken by ventilation louvers and doors and will lack the diversity of the building forms currently on the site, though these buildings are of low architectural interest. The auto-transformer station will be an industrial structure and will appear incompatible in an urban environment. The close proximity of the Proposed Scheme to receptors and the presence of security fencing along the back of the footpath will result in a major alteration to the view. Overall, the magnitude of change is considered to be high.

9.5.27 No planting has been proposed for the vent shaft site and hence the view will be the same in summer and winter.

9.5.28 The high magnitude of change, combined with the high sensitivity of the receptor, will result in a major adverse effect in year 1 of operation.

9.5.29 As no planting has been proposed, operational effects will remain unchanged in year 15 and year 60 compared to year 1.

Viewpoint 019.2.002: Views east, west and south from dwellings on Wells House Road

9.5.30 The new Old Oak Common station and associated buildings in the Old Oak Common depot and the new access from Old Oak Common Lane will be visible from dwellings in Wells House Road. Views from ground floor windows will be partly screened by existing garden fences and vegetation in the foreground. However, the new station and access roads will be clearly visible in the middle ground where there is no screening. The new station building will replace industrial sheds, workshops and offices and will be of a higher architectural quality than the current mixture of buildings on the depot; it will become the focal point of the view. Old Oak Common Lane will be widened, lowered and the bridges over the road replaced. The existing bridges are utilitarian in character and therefore their replacement by new bridges and the changes to the road will result in only minor alterations to the view. Overall the magnitude of change for all is considered to be medium.

9.5.31 Tree planting along the western boundary of the station, along the new station access road and woodland planting on railway land south of Wells House Road will not have established sufficiently to provide any screening in year 1 of operation.

9.5.32 The medium magnitude of change, combined with the high sensitivity of the receptor will result in a moderate beneficial effect in the winter of year 1 of operation.

9.5.33 In the summer of year 1 of operation, the view will be further screened through back garden vegetation but overall effects will remain unchanged.

9.5.34 By year 15 and beyond to year 60 of operation, mitigation planting will have established sufficiently to partly restore the vegetation structure on the land south of Wells House Road. The new trees along Old Oak Common Lane and along the access road to the station will start to enhance views of the station and screen other parts of the depot. However, the limited extent of the planting means that overall operational effects will remain unchanged in years 15 and 60 when compared to year 1.

Viewpoint 020.3.002: View west from Victoria Road play area

9.5.35 The open spaces will be closed during the works and hence there are no receptors in this location during construction. The widening of the A4000 Victoria Road and the loss of the trees in the open space will make the road and the railway bridge more prominent in the view. The road and associated footpath will occupy part of the play area and hence they will be closer to receptors than they currently are. Therefore, the magnitude of change is considered to be medium.

9.5.36 Trees planted in the open spaces along the A4000 Victoria Road remaining after construction will not have established sufficiently to provide any screening in year 1 of operation.

9.5.37 The medium magnitude of change, combined with the high sensitivity of the receptor, will result in a moderate adverse effect in year 1 of operation.

9.5.38 By year 15 and beyond to year 60 of operation, mitigation planting will have established sufficiently to partly restore the vegetation structure in the open spaces and enhance views. However, the limited extent of the planting means that, overall operational effects will remain unchanged in years 15 and 60 when compared to year 1.

Viewpoint 020.2.009: Views west from Midland Terrace and Shaftesbury Gardens

9.5.39 The widening of the A4000 Victoria Road and the loss of all the trees in the open spaces between the road and the viewpoint will result in the road and rail bridge in the foreground of the view and the buildings beyond becoming more prominent. The magnitude of change is considered to be medium.

9.5.40 Trees planted in the open spaces along the A4000 Victoria Road remaining after construction will not have established sufficiently to provide any screening in year 1 of operation and hence the view will be the same in summer and winter.

9.5.41 The medium magnitude of change, combined with the high sensitivity of the receptor, will result in a moderate adverse effect.

9.5.42 By year 15 and beyond to year 60 of operation, mitigation planting will have established sufficiently to partly restore the vegetation structure in the open spaces and enhance views. However, the limited extent of the planting means that the overall operational effects will remain unchanged in years 15 and 60 when compared to year 1.

Cumulative effects

9.5.43 Section 2.1 and Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The consequential cumulative effect of these committed developments on LCA and viewpoints is described below. These developments are shown on Map Series CT-13 (Volume 5, Cross Topic Appendix 1 Map Book).

9.5.44 A redevelopment of Kensal Green Gasworks (RBKC-M1) comprising a mixed use development is planned for this site but there is insufficient information on the proposed development to assess it in terms of cumulative effects. No other developments which might give rise to significant cumulative effects in the study area are currently known.

Other mitigation measures

9.5.45 The permanent effects of the Proposed Scheme on landscape and visual receptors have been substantially reduced through incorporation of the measures described. Effects in the operational phase may be further reduced through development of the design of new bridges and structures, which will be considered during the detailed design stage. However, no other mitigation measures are considered practicable due to the visibility of elements of the Proposed Scheme and the sensitivity of the surrounding receptors.

Summary of likely residual significant effects

9.5.46 As no other mitigation measures are considered practicable, the permanent residual significant effects during operation remain as described above. No mitigation planting is proposed at the Salusbury Road vent shaft site, but the new and replacement planting proposed for Old Oak Common station, the railway corridor south of Wells House Road and on Wormwood Scrubs, will mature and reduce significant effects over time. However, the following residual effects will remain following year 15 of operation:

- the large scale and industrial nature of the vent shaft headhouse, the auto-transformer station and the security fencing at Salusbury Road will continue to be uncharacteristic structures in the landscape. This includes Kilburn Lane and Carlton Vale post-war residential LCA and views including Viewpoints 013.4.003: View east from Kilburn Lane, 013.4.004: View north from Portnall Road, 014.4.001: View south from Salusbury Road and 014.2.002: View east from Claremont Road;
- the new Old Oak Common station building and associated tree planting will continue to enhance views in the area around the station including Viewpoint 019.2.002: Views east, west and south from dwellings on Wells House Road; and
- the play area and other open spaces in Victoria Road will be permanently reduced, but mitigation planting will gradually restore part of the former vegetation structure and screen views of the road from visual receptors close by including Viewpoint 020.3.002: View west from Victoria Road play area and 020.2.009: Views west from Midland Terrace and Shaftesbury Gardens .

10 Socio-economics

10.1 Introduction

10.1.1 This section reports the likely significant economic and employment effects during construction and operation of the Proposed Scheme.

10.1.2 The need for a socio-economic assessment results from the potential for the Proposed Scheme to affect:

- existing businesses and community organisations and thus the amount of local employment;
- local economies, including employment; and
- planned growth and development.

10.1.3 The beneficial and adverse socio-economic effects of the Proposed Scheme are reported at two different levels: route-wide; and CFA. Effects on levels of employment are reported at a route-wide level in Volume 3. Localised effects on businesses and observations on potential local economic effects are reported within each CFA report.

Construction

10.1.4 The following issues have been considered:

- premises demolished, with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme;
- effects on the amenity (e.g. air quality and construction dust, noise and vibration, construction traffic and visual impacts) of an area which could affect business operations. Any resulting effects on employment are reported at a route-wide level; and
- potential employment opportunities arising from construction in the local area (including in adjacent CFA).

Operation

10.1.5 The proposed operation of the route will have relevance in terms of socio-economics, in relation to potential employment opportunities created by new business opportunities.

10.2 Scope, assumptions and limitations

10.2.1 The assessment scope, key assumptions and limitations for the socio-economics assessment are set out in Volume 1, Section 8, and in the SMR (Volume 5: Appendix CT-001-000/1) and the SMR addendum (Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

10.2.2 There have been no variations to the socio-economic assessment methodology following engagement with stakeholders and community organisations.

10.3 Environmental baseline

Existing baseline

Study area description

10.3.1 Section 2.1 of this report provides a general overview of the area which includes data of specific relevance to socio-economics, notably demographic and employment data. The following provides a brief overview in terms of employment, economic structure, labour market, and business premises availability within the area[49].

10.3.2 The Kilburn (Brent) to Old Oak Common area lies within the LBB, LBE, LBHF, the RBKC and the CoW. The focus of this environmental baseline is on LBB, LBE and LBHF, given that both the RBKC and CoW constitute very small parts of the area.

10.3.3 Where possible, baseline data has been gathered on demographic character areas (DCA)[50] to provide a profile of local communities. Volume 5: Appendix SE-001-000 shows the location of the DCA. The area contains two DCA - Kilburn and Old Oak Common.

10.3.4 Old Oak Common lies within the Park Royal/Willesden Junction Opportunity Area. This is an area with significant capacity to accommodate new housing, commercial and other development linked to existing or potential improvements to public transport accessibility - as identified in Policy 2.13 of the London Plan 2011[51]. Annex 1 of the London Plan outlines the broad principles for the Opportunity Area's development, and estimates that the area has potential to provide around 14,000 jobs and a minimum of 1,500 new homes to 2031. It also emphasises the role of Park Royal as a 'strategic industrial location' and seeks to promote, manage and, where appropriate, protect the Strategic Industrial Location as one of London's main reservoirs of industrial and related capacity.

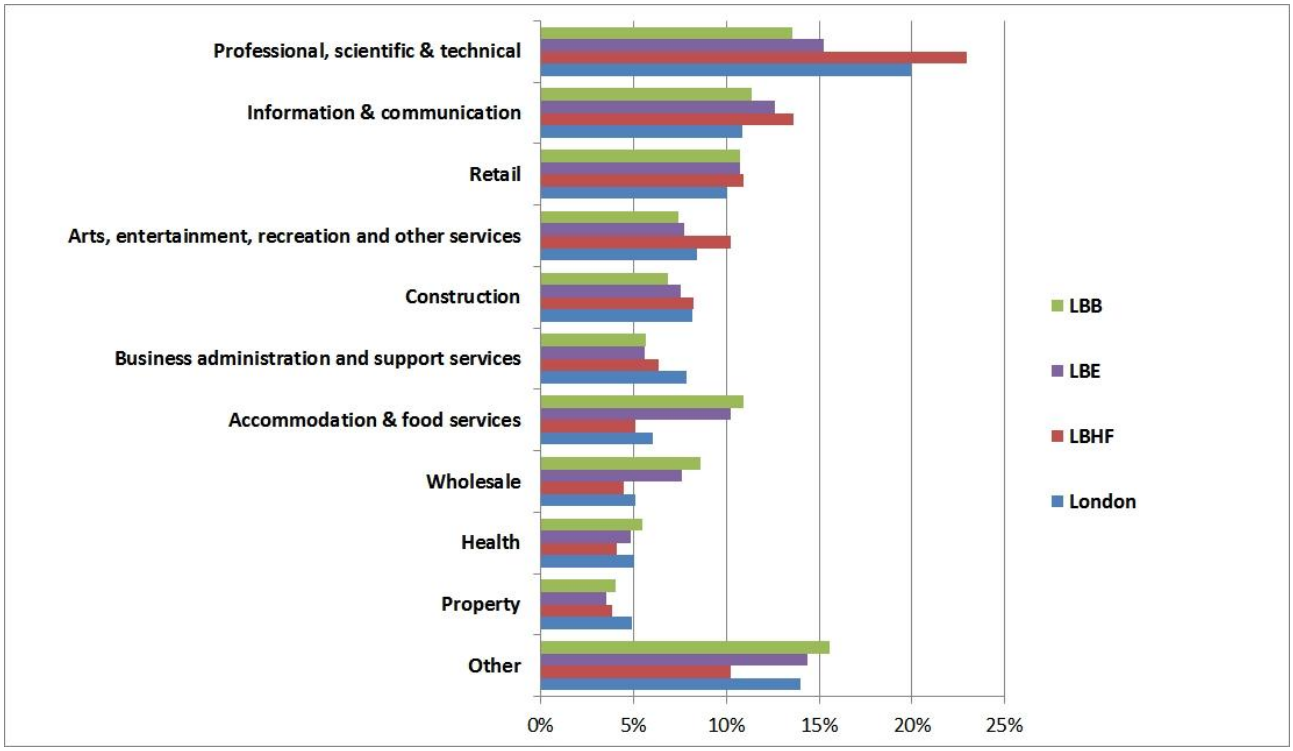
Business and labour market

10.3.5 The professional, scientific and technical services sector accounts for the largest proportion of businesses in LBB, LBE and LBHF (14%, 15% and 23% respectively), with information and communication also accounting for a large proportion in each (11%, 13% and 14% respectively). Retail businesses account for 11% of businesses in each borough. A detailed breakdown of sector composition is shown in Figure 12[52]. For comparison within London, the professional, scientific and technical services sector accounts for the largest number of businesses (20%), with the information and communication (11%), retail (10%) and arts, entertainment, recreation and other

[49] Further information on the socio-economics baseline within the area including a business and labour market profile is contained in Volume 5: Appendix SE-001-000.
[50] DCA have been determined through an understanding of local context and aim to be aligned as closely as possible to groups of lower super output areas.
[51] Greater London Authority (2011), *The London Plan: Spatial Development Strategy for Greater London.*
[52] The figure presents the proportion of businesses within each business sector in the borough but not the proportion of employment by sector.

services (8%) sectors also accounting for relatively large numbers of businesses within the region[53].

Figure 12: Business sector composition in LBB, LBE, LBHF and London [54] [55]



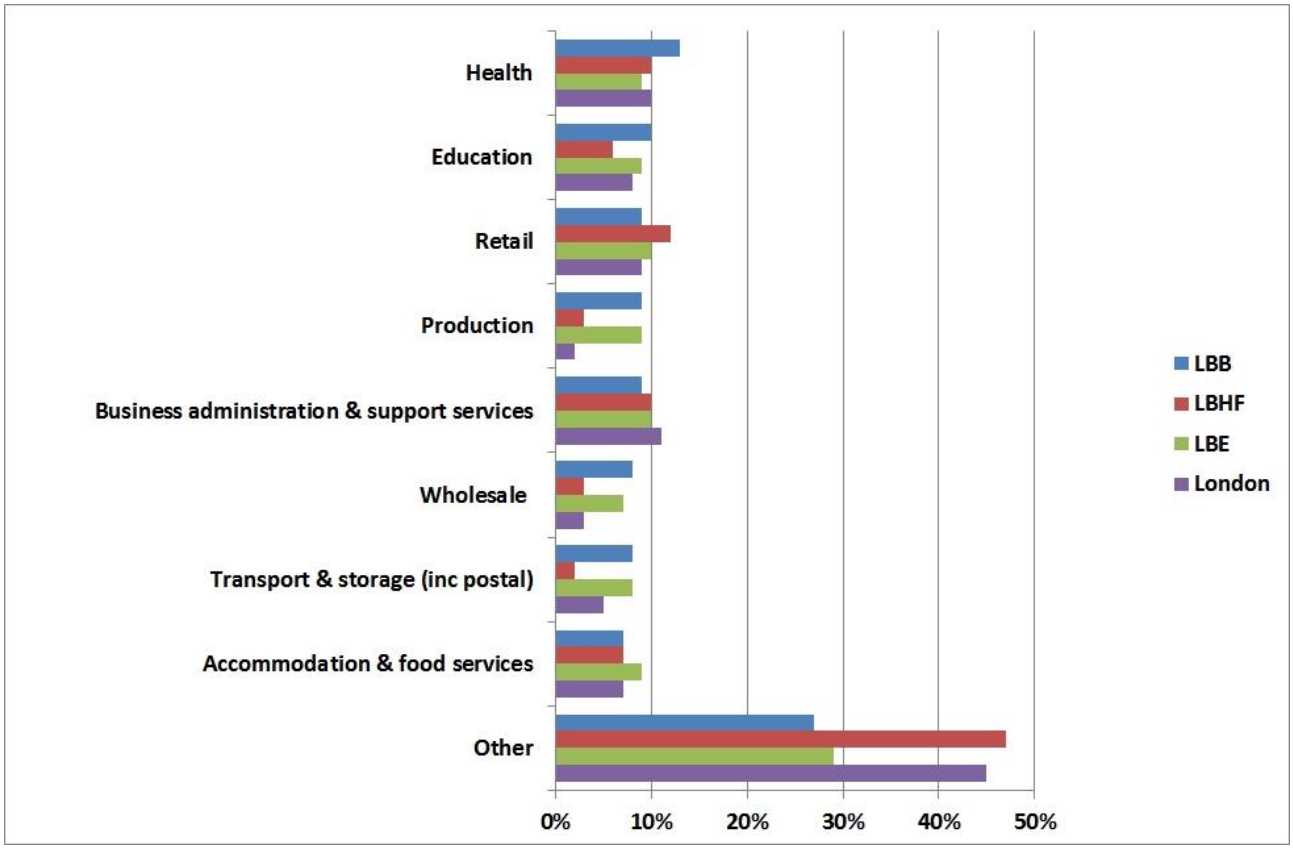
10.3.6 Approximately 101,000 people worked in LBB, 121,000 in LBE, and 125,000 in LBHF, whilst 13,000 people worked within the Kilburn DCA and 22,000 worked within the Old Oak Common DCA[56].

10.3.7 The sector accounting for the highest proportion of employment in LBB in 2011 is health which at 13% is higher than in LBE (9%) and LBHF (10%) and London (10%). The retail sector accounts for 9% of employment in LBB, 11% in LBE and 12% in LBHF - all slightly above or broadly in line with that recorded for London (9%) and England (10%). The business administration and support services sector makes up 8% of employment in LBB and 10% in LBE and LBHF, in line with London (10%) as a whole. This is shown in Figure 13.

10.3.8 Key sectors in terms of employment, for Kilburn DCA are education (14%), professional, scientific and technical (11%), health (11%), retail (10%) and information and communication (10%). For Old Oak Common DCA, key sectors are information and communication (18%), health (14%) and wholesale (11%).

[53] Office for National Statistics (2012), *UK Business: Activity, Size and Location 2011*, Office for National Statistics, London. Please note that 2011 data has been used to provide an appropriate comparison with 2011 Census data.
[54] 'Other' includes agriculture, forestry and fishing, production, motor trades, transport and storage, finance and insurance, public administration and defence and education sectors.
[55] Office for National Statistics (2012), *UK Business: Activity, Size and Location 2011*, Office for National Statistics, London.
[56] Office for National Statistics (2012), *Business Register and Employment Survey 2011*, Office for National Statistics, London.

Figure 13: Employment by industrial sector in LBB, LBE, LBHF and London[57] [58]



10.3.9 According to the 2011 Census[59], the employment rates[60] within LBB, LBE and LBHF were 63%, 65% and 68% respectively, broadly in line with the rate for London and England (both 65%). The employment rate in Kilburn DCA was 65% and 62% in Old Oak Common. Unemployment rates in LBB, LBE and LBHF stood at 10%, 9% and 8% compared with a 7% average recorded for England. The unemployment rate in the Kilburn DCA was 10% and 11% for the Old Oak Common DCA[61].

10.3.10 In 2011, 33% of LBB, 37% of LBE and 50% of LBHF residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4), compared to 38% in London and 27% in England. Whilst 17% of residents in LBB, 17% in LBE and 13% in LBHF had no qualifications, a lower rate than that recorded both for London (18%) and England (23%).

10.3.11 According to the 2011 Census, 42% of Kilburn DCA residents aged 16 and over were qualified to NVQ4 level, compared to 34% in Old Oak Common DCA. The proportion of residents with no qualifications was 12% in Kilburn DCA and 15% in Old Oak Common DCA.

[57] 'Other' includes information and communication, construction, arts, entertainment, recreation and other services, financial and insurance, motor trades, property, and agriculture, forestry and fishing.
[58] Office for National Statistics (2012), *Business Register and Employment Survey 2011*, Office for National Statistics, London.
[59] Office of National Statics (2012), *Census 2011*, Office for National Statistics, London.
[60] The proportion of working age (16-74 years) residents in employment. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.
[61] Unemployment figures have been rounded to the nearest whole number. DCA unemployment rates are presented for each DCA in this section while in Section 2 they are shown in aggregate.

10.3.12 Kilburn DCA is predominantly a residential area, with Old Oak Common DCA being a predominantly employment area in character. Both Kilburn and Old Oak Common DCAs experience comparatively high levels of unemployment despite skills levels being either comparable or better than local and regional comparisons.

Property

10.3.13 Data for quarter four of 2012, published by Knight Frank, indicated that in the north-west sector of the M25 office market (which includes the five boroughs in this area), floorspace vacancy was estimated at around 9% of total stock[62].

10.3.14 In LBB total commercial office stock in 2012 was estimated to be 277,000m^2 [63]. Data published by the LBB in September 2012 indicated that 9,500 m^2 of this was vacant, equating to a vacancy rate of 4% [64].

10.3.15 In LBE total commercial office stock in 2012 was estimated to be 442,000m^2 [65]. The 2010 Ealing Employment Land Review estimated, in 2010, that "up to a third of the Borough's office floorspace was vacant"[66].

10.3.16 Vacancy for office property in July 2013 has been assessed as 9% within LBE, based on marketed space against known stock[67]. Overall, this suggests good availability of alternative office accommodation.

10.3.17 Data for quarter three of 2012, published by Jones Lang LaSalle, indicated that 10% of the 4 million m2 of industrial and warehousing floorspace in west London was vacant[68]. In the LBE itself total industrial/warehousing stock is estimated to be 2.5 million m2.

10.3.18 Vacancy for industrial and warehousing property in July 2013 has been assessed as 8% within the LBB and the LBE respectively, based on marketed space against known stock[69]. Overall, this suggests adequate availability of alternative accommodation.

Future baseline

Construction (2017)

10.3.19 Volume 5: Appendix CT-004-000 provides details of developments which are assumed to have been implemented by 2017. Based on extant planning applications and allocations it is anticipated that the number of jobs in the area, due to new developments, will increase by at least an additional 25 jobs by 2017. In addition,

[62] Knight Frank (2013), M25 Offices: Quarter 4 2012.
[63] Valuation Office Agency (2012), *Business Floorspace (Experimental Statistics),* Available at http://www.voa.gov.uk/corporate/statisticalReleases/120517_CRLFloorspace.html accessed 27 February 2012.
[64] Colliers/Brent Council (2012), *Wembley Office Market Report (September 2012)*, Colliers, London.
[65] Valuation Office Agency (2012), Business Floorspace (Experimental Statistics), Available at http://www.voa.gov.uk/corporate/statisticalReleases/120517_CRLFloorspace.html accessed 27 February 2012.
[66] Roger Tym and Partners/Lambert Smith Hampton (2010), London Borough of Ealing Employment Land Review.
[67] Vacant space is based on marketed space identified from Estates Gazette data (EGi); stock data is taken from information supplied by the Valuation Office (VOA).
[68] Jones Lang LaSalle (2012), The Western Corridor Industrial and Warehouse Market Report (September 2012).
[69] Vacant space is based on marketed space identified from Estates Gazette data (EGi); stock data is taken from information supplied by the Valuation Office (VOA).

approximately a further 330 jobs attributable to proposed office employment uses will be unable to proceed as a result of the Old Oak Common station works footprint (12/0788 (LBB), P/2010/2215/ and P/2012/3473 (LBE))[70] however there are a number of other development sites in the wider Park Royal/Willesden Junction Opportunity Area which can accommodate additional demand for employment uses. The existing composition and numbers of employers, employees and economic sectors in the area is likely to change over time in ways that cannot be accurately forecast.

Operation (2026)

10.3.20 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2026. There are no consents in this area which are expected to accommodate significant additional employment between 2017 and2026. Although currently not part of committed developments, it is recognised that the wider Park Royal/Willesden Junction Opportunity Area potentially could accommodate a further 14,000 jobs to 2031[71].

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 The following measures have been incorporated into the Proposed Scheme design as part of the design development process to avoid or minimise the environmental impacts during construction:

- Replacement depot facilities for FGW and Hex will be provided at the North Pole depot, in the vicinity of their existing depot locations, subject to on-going detailed operational modelling work as part of Network Rail's GRIP 3 process[72]. Should it be determined that an available alternative site is more suitable for either service, this will be the subject of separate environmental impact assessment and consents (see Volume 4, Sections 6 and 7 for further detail).
- the FGW and HEx railway depots will be provided with replacement accommodation in the vicinity of their existing locations at/adjacent to the North Pole depot (see Volume 4, Sections 6 and 7 for further detail);
- provision has been made to ensure that two bus depots at Atlas Road can remain operational throughout the works through reconfiguration of their facilities; and
- the route has been aligned to minimise the number of resources affected during construction within the Park Royal Strategic Industrial Location, particularly at Hythe Road.

10.4.2 The draft CoCP includes a range of provisions that will help mitigate socio-economic effects associated with construction within this area, including:

[70] These planned developments are described in Volume 5: Appendix CT-004--000.
[71] Greater London Authority (2011), *The London Plan: Spatial Development Strategy for Greater London.*
[72] Governance for Railway Investment Projects (GRIP), Stage 3, Option Selection.

- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (draft CoCP, Section 5);
- reducing nuisance through sensitive layout of construction sites (draft CoCP, Section 5);
- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (draft CoCP, Section 13);
- requiring contractors to monitor and manage flood risk and other extreme weather events which may affect socio-economic resources during construction (draft CoCP, Sections 5 and 16); and
- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (draft CoCP, Section 14).

Assessment of impacts and effects

Temporary effects

Change in business amenity value

10.4.3 Businesses within the area may experience air quality, noise and vibration, visual or construction traffic impacts as a result of construction of the Proposed Scheme. Taken in combination, the residual effects from these other topic assessments may amount to a significant change in amenity which leads to a possible loss of trade for the affected businesses.

10.4.4 The Holiday Inn Hotel on Victoria Road may experience potentially significant noise and visual effects as a result of the proposed construction activities associated with the Victoria Road crossover box main compound. The sensitivity of this establishment is considered to be high as users are considered to be susceptible to changes in amenity with the construction works likely to discourage guests. These in-combination effects will occur over a period of five years and given the high level of sensitivity, the Proposed Scheme is assessed to have a significant amenity effect on this business.

10.4.5 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3).

Isolation

10.4.6 No businesses have been identified within the area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

10.4.7 Construction compounds for the Proposed Scheme within the study area are described in Section 2.3.

10.4.8 These will result in the creation of up to 7,800 person years of construction employment[73] opportunities, or approximately 780 full-time equivalent jobs[74], that, depending on skill levels required and the skills of local people, are potentially accessible to residents in the locality and to others living further afield. The impact of direct construction employment creation has been assessed as part of the route-wide assessment (see Volume 3).

10.4.9 Direct construction employment created by the Proposed Scheme will also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of the indirect construction employment creation has been assessed as part of the route-wide assessment (see Volume 3).

Cumulative effects

10.4.10 No committed developments have been identified that are considered to interact with the Proposed Scheme.

10.4.11 Cumulative effects may arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed as part of the route-wide assessment (see Volume 3).

10.4.12 Combined effects may arise where business establishments are affected by other environmental effects (from noise, vibration, air quality, visual and construction traffic) such that their ability to trade is disadvantaged thereby potentially prejudicing jobs in business establishments affected. These effects are identified in this section and assessed in the route-wide assessment (see Volume 3).

Permanent effects

Businesses

10.4.13 Businesses directly affected, i.e. those that lie within the land which will be used for the construction of the Proposed Scheme, are reported in groups where possible to form defined resources, based on their location and operational characteristics. A group could contain either one or a number of businesses.

10.4.14 In all, 38 business accommodation units within the area will be directly impacted upon by the Proposed Scheme. Together, these form 20 defined resources. Five of the resources which experience direct impacts are subject to potentially significant effects on business activities and employment. These are listed in Table 13.

Table 13: Resources with potentially significant direct effects

Resource	Description of business activity
John Lewis Partnership, 96 Victoria Road	Large warehouse/distribution centre

[73] Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.
[74] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

Retail warehouse on Atlas Road	A retail warehouse accommodating Makro Multi Trade Centre
Quattro (UK)	Aggregates distribution site
Premier House, Kilburn Lane	London Underground Bakerloo line welfare facility
Tarmac, Willesden Euroterminal	Storage cement silos

Impact magnitude

10.4.15 The magnitude of impact focuses on the number of jobs which are affected (either through displacement or possible loss) by the Proposed Scheme. It also considers the implications of this impact in relation to the scale of economic activity and opportunity in the area.

Sensitivity

10.4.16 The following was taken into account when considering the sensitivity of resources:

- availability of alternative, suitable premises;
- size of the local labour market;
- skill levels and qualifications of local people; and
- levels of unemployment.

Significance of effect

10.4.17 Taking account of the sensitivity of the resource and the magnitude of impact, the significance of the resultant effects is set out in Table 14.

Table 14: Significant effect significance on socio-economic resources

Resource	Impact magnitude	Sensitivity	Significance of effect
John Lewis Partnership, 96 Victoria Road	High	Low	Moderate adverse
Retail warehouse on Atlas Road	High	Low	Moderate adverse
Quattro (UK) site	High	Low	Moderate adverse
Premier House, Kilburn Lane	High	Medium	Major adverse
Tarmac	Low	High	Moderate adverse

10.4.18 Construction of the Proposed Scheme will require the demolition of a warehouse/distribution centre (Waitrose and John Lewis) at 96 Victoria Road while the occupiers of a large retail warehouse on Atlas Road will no longer be able to operate from their current location given the structure of the building will be utilised by HS2 Ltd. The availability of alternative space should be a reasonable prospect for occupiers although the large size of each of the properties could mean that they encounter difficulties in relocating near to their current premises. The effect on these resources and its employees is assessed to be moderate adverse and will therefore be significant.

10.4.19 Construction of the Proposed Scheme will require the demolition and use of land occupied by Quattro (UK). The availability of alternative space should be a reasonable prospect for the occupier although the large size of the property could mean that they encounter difficulties in relocating near to their current location. The effect on these resources and its employees is assessed to be moderate adverse and will therefore be significant.

10.4.20 Construction will also require the demolition of a London Underground Limited train crew facility in an office building at Premier House, Kilburn Lane. The activity affected is dependent upon a location close to the railway and therefore alternative space will need to be obtained nearby. The effect on these resources and its employees is assessed to be major adverse and will therefore be significant.

10.4.21 Tarmac currently has two silos situated on the Euroterminal site. Materials are transported by train to the Euroterminal site. Once there, the materials are placed into the silos for storage until they can be transported to other sites throughout London, once again via rail. HS2 Ltd will be demolishing these silos to allow for a construction site on the Euroterminal site. The activity affected is dependent upon a location close to the railway. The effect on this resource and its employees is assessed to be moderate adverse and will therefore be significant.

10.4.22 There is also one property, the Westwood Business Centre, where the construction footprint requires the demolition of the property but where the associated employment losses do not present particular relocation problems given the type of premises that these occupiers will require and the availability of alternative premises.

10.4.23 It is estimated that the Proposed Scheme will result in the displacement or possible loss of around of 1,540 jobs[75] within this area. However, taking into account total employment within the boroughs the impact on the local economy from the loss/relocation of jobs is considered to be relatively modest compared to the scale of economic activity and opportunity in the area.

Cumulative effects

10.4.24 No committed developments have been identified that are considered to interact with the Proposed Scheme.

10.4.25 Cumulative effects also arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are dealt with as part of the route-wide assessment (see Volume 3).

[75] Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floorspace and the Homes and Communities Agency (HCA) (2010, 2nd ed.), *Employment Densities Guide* .

Other mitigation measures

10.4.26 The above assessment has concluded that there are significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme.

10.4.27 Businesses displaced by the Proposed Scheme will be fully compensated within the provisions of the Compensation Code. HS2 Ltd recognises the importance of displaced businesses being able to relocate to new premises and will therefore provide additional support over and above statutory requirements to facilitate this process.

10.4.28 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents along the line of route in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to providing support to businesses and local residents to facilitate access to procurement and employment opportunities arising from the construction of the Proposed Scheme.

Summary of likely significant residual effects

10.4.29 The residual significant socio-economic effects that will arise during construction of the Proposed Scheme are the same as those reported above, as illustrated on Maps SE-01-006b to SE-01-009-R1 (Volume 5, Socio-economics Map Book).

10.4.30 The Proposed Scheme will require the demolition of five significantly affected socio-economic resources in the area. During construction of the Proposed Scheme, customers may be discouraged from using the Holiday Inn Hotel on Victoria Road as a result of construction activities associated with the Victoria Road crossover box compound.

10.5 Effects arising during operation

Avoidance and mitigation measures

10.5.1 No mitigation measures are considered to be required during operation within this area.

Assessment of impacts and effects

Resources with direct effects

10.5.2 There are no resources considered likely to experience significant direct effects during the operational phase of the project within this area.

Change in business amenity

10.5.3 No businesses have been identified within the area that are expected to experience significant amenity effects as a result of the Proposed Scheme.

Operational employment

10.5.4 The Proposed Scheme will create direct operational employment opportunities at locations along the route including stations, train crew facilities and

infrastructure/maintenance depots. Within this area there will be a station at Old Oak Common and initial estimates suggest that gross direct employment for station operations may be approximately 100 jobs.

10.5.5 Indirect employment opportunities will also arise through the ability for local businesses to supply the high speed rail operator, local spending arising from local businesses requiring more services and supplies arising from increased foot traffic, or through local businesses benefitting from the expenditure of directly employed workers on goods and services.

10.5.6 The Old Oak Common site is located within the Park Royal Opportunity Area, identified in the Mayor of London's planning framework. Old Oak Common station will provide rapid and convenient access to central London and destinations on the national network. HS2 services from Old Oak Common station will provide additional linkages to the West Midlands and the north of England and Scotland as well as mainland Europe. The Opportunity Area Planning Framework identifies substantial capacity in the area to accommodate commercial and other development, with the scale of development closely linked to the extent of the transport hub created by Crossrail and HS2 services.

10.5.7 The LBHF, LBE, LBB have been working with the GLA and TfL to produce the 'Vision for Old Oak', which, if adopted by the GLA as a future Opportunity Area Planning Framework will inform revisions to local planning policy. In reconsidering the area's role and the potential opportunities that a HS2 interchange station will create, the GLA launched a consultation on this document in June 2013. The document recognises that Old Oak Common could be one of the best connected railway stations in the UK, giving rise to the transformation of the area with up to 90,000 jobs and up to 19,000 new homes, schools, open spaces, shops and leisure facilities. The consultation on the 30 year vision for Old Oak closed on 6 September 2013.

10.5.8 Some of these employment opportunities will be accessible to residents in the locality and, given the transport accessibility of the area within the London travel to work area, residents living further afield.

10.5.9 The impact of operational employment creation has been assessed as part of the route-wide assessment (Volume 3).

Cumulative effects

10.5.10 No committed developments have been identified that are considered to interact with the Proposed Scheme.

Other mitigation measures

10.5.11 The above assessment has concluded that operational effects within the area will be either negligible or beneficial and therefore mitigation is not needed.

Summary of likely significant residual effects

10.5.12 No significant adverse socio-economic effects arising during operation have been identified within this assessment.

11 Sound, noise and vibration

11.1 Introduction

11.1.1 This section reports the assessment of the likely noise and vibration significant effects arising from the construction and operation of the Proposed Scheme for the Kilburn (Brent) to Old Oak Common area on:

- people, primarily where they live ('residential receptors') in terms of a) individual dwellings and b) on a wider community basis, including any shared community open areas[76]; and
- community facilities such as schools, hospitals, places of worship, and also commercial properties such as offices and hotels, collectively described as 'non-residential receptors' and 'quiet areas'[77].

11.1.2 The assessment of likely significant effects from noise and vibration on community, ecological or heritage receptors and the assessment of tranquillity are presented in Sections 5, 6, 7 and 9 of this report respectively.

11.1.3 In this assessment 'sound' is used to describe the acoustic conditions which people experience as a part of their everyday lives. The assessment considers how those conditions may change through time and how sound levels and the acoustic character of community areas is likely to be modified through the introduction of the Proposed Scheme. Noise is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.

11.1.4 Effects can either be temporary from construction or permanent from the operation of the Proposed Scheme. These effects may be direct, resulting from the construction or operation of the Proposed Scheme, and/or indirect e.g. resulting from changes in traffic patterns on existing roads or railways that result from the construction or operation of the Proposed Scheme.

11.1.5 This section sets out the means to avoid or reduce the adverse effects that may occur. The approaches to assessing sound, noise and vibration and appropriate mitigation are outlined in Volume 1 and scope and methodology are defined in the following documents:

- Scope and Methodology Report (SMR) (Appendix CT-001-000/1); and
- SMR addendum (Appendix CT-001-000/2).

[76] 'shared community open areas' are those that the emerging National Planning Practice Guidance identifies may partially offset a noise effect experienced by residents at their dwellings and are either a) relatively quiet nearby external amenity spaces for sole use by a limited group of residents as part of the amenity of their dwellings or b) a relatively quiet external publicly accessible amenity space (e.g. park to local green space) that is nearby.

[77] Quiet areas are defined in the Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity (further information is provided in Volume 5: Appendix SV-001-000).

11.1.6 More detailed information and mapping regarding the sound, noise and vibration assessment for Kilburn (Brent) to Old Oak Common is available in the relevant appendices in Volume 5:

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000);
- sound, noise and vibration baseline (Appendix SV-002-004);
- sound, noise and vibration construction assessment (Appendix SV-003-004);
- sound, noise and vibration operation assessment (Appendix SV-004-004); and
- Map Series SV-01, SV-02, SV-03 and SV-04 (Volume 5, Sound, noise and vibration Map Book).

11.2 Environmental baseline

Existing baseline

11.2.1 The Proposed Scheme, with the exception of the vent shaft at Salusbury Road, the station at Old Oak Common and the Victoria Road crossover box, is in tunnel throughout this area.

11.2.2 The existing baseline sound environment around the vent shaft site at Salusbury Road is typical for an urban situation with busy main roads and nearby railways. Daytime sound levels are typically 65 to 70dB[78] in the vicinity of the railway bridge, where existing sound levels are determined by the nearby NLL railway, B413 Kilburn Lane and Salusbury Road.

11.2.3 The existing baseline sound environment around the proposed Old Oak Common station site consists of a mixture of transportation, industrial and commercial sources. The railway lines here include the WCML, GWML, AML and NLL. In addition, the London Underground Central and Bakerloo lines also run through this area.

11.2.4 In much of the Old Oak Common area, the soundscape is dominated by nearby road and rail traffic, with distant road traffic from the A40 audible in some locations. This leads to a large variation in sound level dependent upon location, and daytime sound levels typically range between 55dB and 75dB. During less busy periods of road and rail traffic flow, natural sound sources are more apparent.

11.2.5 Night-time sound levels[79] in this area are typically 5 to 10dB lower than those during the day; with the greater reduction in the locations furthest or screened from the main transportation sources.

[78] Quoted dB values at residential areas refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, LpAeq,16hr.
[79] Night-time sound levels refer to the free-field 8 hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, $L_{pAeq,8hr.}$

11.2.6 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-004.

11.2.7 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration, save for those receptors closest to existing railways. On a reasonable worst case basis, vibration from the Proposed Scheme has therefore been assessed at all receptors using specific thresholds, below which receptors will not be affected by vibration, as described in Volume 1, Section 8. Consequently no vibration baseline measurements are reported in the ES.

Future baseline

11.2.8 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth, but may also include changes in train movements. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads[80], tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

11.2.9 The assessment of noise from construction activities assumes a baseline year of 2017 which represents the period immediately prior to the start of the construction period. As a reasonable worst case, it has been assumed that no change in baseline sound levels will occur between the existing baseline (2012/13) and the future baseline year of 2017. The assessment of noise from construction traffic assumes a baseline year of 2021, representative of the middle of the construction period when the construction traffic flows are expected to be at their peak. Further information can be found in the Traffic and Transport assessment.

Operation (2026)

11.2.10 The assessment is based upon the predicted change in sound levels that result from the Proposed Scheme. The assessment initially considered a worst case (that would overestimate the change in levels) by assuming that sound levels will not change from the existing baseline year of 2012/2013. Where significant effects were identified on this basis, the effects have been assessed using a baseline year of 2026 to coincide with the proposed start of passenger services. The future baseline is for the sound environment that will exist in 2026 without the Proposed Scheme.

[80] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

11.3 Effects arising during construction

Local assumptions and limitations

Local assumptions

11.3.1 The construction arrangements that form the basis of the assessment are presented in Section 2.3 of this report.

11.3.2 The following activities are likely to be undertaken during the evening and night-time for reasons of safety, engineering practicability or to reduce the impact on existing transport. Further information is provided in Section 2.3 of this report and in the draft CoCP:

- major civil works such as piling, diaphragm walls and major concrete pours during extended hours at Old Oak Common station main compound and Victoria Road crossover box main compound;
- continuous surface support activities for the Euston tunnel, HS1-HS2 Link tunnel and Northolt tunnel construction at Victoria Road tunnel drive main compound;
- continuous operation of conveyors, pumping equipment and essential generators at Old Oak Common station main compound, Victoria Road crossover box main compound and Willesden Euroterminal main compound;
- movement of trains into and out of the sidings during the day, evening and night from the Willesden Euroterminal main compound; and
- loading and movement to site of tunnel lining segments at Atlas Road satellite compound and Victoria Road crossover box main compound.

11.3.3 The assessment takes account of people's perception of noise throughout the day. More stringent criteria are applied during evening and night-time periods, when people are more sensitive to noise, compared to the busier and more active daytime period.

11.3.4 In addition to the above, it is anticipated that there may be some night-time working during works to cross or tie into existing roads and railways, although it is expected that the noise effects will be limited in duration and will hence not be considered significant. Any noise effects arising from these short term construction activities will be controlled and reduced by the management processes set out in the draft CoCP.

11.3.5 TBM will be used to excavate the tunnels. Materials (including tunnel lining segments), people and equipment will be transported from the surface construction compounds to each TBM using small construction trains, which will travel at relatively low speeds. Excavated material from each TBM will be transported to the surface construction compounds by conveyor. It has been assumed that significant noise and vibration effects arising from use of the temporary railway will be avoided through appropriate design and maintenance specification. Other methods for material

movement may be employed; however, these will result in lower ground-borne noise and vibration.

Local limitations

11.3.6 In this area, there are a number of locations where the land or property owners, or occupiers did not permit baseline sound level monitoring to be undertaken at their premises. However, sufficient information has been obtained to undertake the assessment. Further information is set out in Volume 5: Appendix SV-003-022.

Avoidance and mitigation measures

11.3.7 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP which are:

- best practicable means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA) will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings; and then
  - screening: for example local screening of equipment or perimeter hoarding;
- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-housing will be offered in accordance with the draft CoCP's noise insulation and temporary re-housing policy;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise, including control of working hours, and provide a further assessment of construction noise and vibration including confirmation of noise insulation/temporary re-housing provision;
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to and be reviewed by the Nominated Undertaker and will be made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.8 In addition to this mitigation, taller screening as described in the draft CoCP[81] has been assumed along the edge of the construction site boundaries at Old Oak Common adjacent to residential communities at Wells House Road, Wales Farm Road, Shaftesbury Gardens, Midland Terrace, Victoria Road, Bashley Road, Old Oak Common Lane and Stephenson Street. In addition taller screening has been assumed around the Salusbury Road vent shaft compound.

11.3.9 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP's noise insulation and temporary re-housing policy. Noise insulation or ultimately temporary re-housing will avoid residents being significantly affected[82] by levels of construction noise inside their dwellings. The assessment reported in this section provides an estimate of the buildings that are likely to qualify for such measures.

11.3.10 Qualification for noise insulation and temporary re-housing will be identified as part of seeking prior consent from the local authorities under Section 61 of the Control of Pollution Act. Qualifying buildings will be identified early enough so that noise insulation can be installed, or temporary re-housing provided, before the start of the works predicted to exceed noise insulation or temporary re-housing criteria. Noise insulation, where required, will be installed as early as possible to reduce internal sound levels from construction activities and also when the Proposed Scheme comes into operation.

Assessment of impacts and effects

Residential receptors: direct effects - individual dwellings

11.3.11 Taking account of the avoidance and mitigation measures set out in the previous paragraphs, the following residential buildings are forecast to experience noise levels higher than the noise insulation trigger levels as defined in the draft CoCP. For daytime construction the trigger level is 75dB[83] measured outdoors, or the existing ambient if this is already above this level. The equivalent night-time trigger level is 55dB[84]:

- William Dunbar House (approximately 10 dwellings), Albert Road;
- Cullen House (approximately 10 dwellings), Salusbury Road;
- Claremont Court, Claremont Road (approximately 5 dwellings) and 307 Kilburn Road;
- 332 - 335 Kilburn Lane (approximately 15 dwellings);
- 30 buildings/houses (approximately 30 dwellings) on Stephenson Street;

[81] As described in the draft CoCP, provided as necessary by solid temporary hoarding, temporary earth stockpiles, screening close to the activities or other means to provide equivalent noise reduction.
[82] Department for Communities and Local Government, *National Planning Practice Guidance - Noise*. http://planningguidance.planningportal.gov.uk.
[83] $L_{pAeq,0800\text{-}1800}$ measured at the façade.
[84] $L_{pAeq,2200\text{-}0700}$ measured at the façade, outdoors, or the existing ambient if this is already above this level.

- 4 residential buildings (approximately 25 dwellings) on Shaftesbury Gardens;
- 75 buildings (approximately 75 dwellings facing east and west - those facing west are forecast to exceed the night-time trigger) on Wells House Road; and
- 3 residential buildings (approximately 60 dwellings) on the Victoria Road/Chase Road gyratory.

11.3.12 The mitigation measures, including noise insulation, will reduce noise inside all dwellings such that it does not reach a level where it will significantly affect residents.

Residential receptors: direct effects -communities

Airborne noise

11.3.13 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

11.3.14 In locations with lower existing sound levels[85], construction noise adverse effects are likely to be caused by changes to noise levels outside dwellings. These may be considered by the local community as an effect on the acoustic character of the area and hence be perceived as a change in the quality of life. These adverse effects are considered to be significant when assessed on a community basis taking account of the local context[86].

11.3.15 The direct adverse construction noise effects on the areas of the residential communities identified in Table 15 are considered to be significant.

Table 15: Direct adverse effects on residential communities and shared open areas that are considered to be significant on a community basis

Significant effect number (see Volume 5 Appendix SV-003-004)	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact
CSV04-C01	Construction noise	Daytime	Approximately: 20 dwellings in Winterleys, Albert Road; 20 dwellings in Watling Place, Albert Road; 10 dwellings in Bond House, Rupert Road; 10 dwellings in Thames Court, Albert Road; and 45 dwellings in William Dunbar House, Albert Road	Salusbury Road vent shaft - demolitions, site setup, site preparation, diaphragm wall construction and top/intermediate slab construction with typical and highest monthly noise levels of 60-70dB and 70-75dB	6 - 16 months

[85] Further information is provided in Volume 5: Appendix SV-001-000.
[86] Further information is provided in SV-001-000 and SV-003-004.

Significant effect number (see Volume 5 Appendix SV-003-004)	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact
CSV04-C02	Construction noise	Daytime	Approximately: 30 dwellings in Cullen House, Salusbury Road; 15 dwellings on Kilburn Lane; 10 dwellings in Claremont Court, Claremont Road; 10 dwellings on Claremont Road; and 15 dwellings on Kilburn Lane	Salusbury Road vent shaft - demolitions, site setup, site preparation, diaphragm wall construction and top/intermediate slab construction with typical and highest monthly noise levels of 65-75dB and 75-85dB	6 - 18 months
CSV04-C03	Construction noise	Daytime	Approximately 20 dwellings on Brondesbury Road	Salusbury Road vent shaft - demolitions with typical and highest monthly noise levels of 60dB and 70dB	4 months
CSV04-C04	Construction noise	Daytime	Approximately 30 dwellings on Stephenson Street and 10 dwellings on Goodhall Street	Atlas Road satellite compound - demolitions and site preparation with typical and highest monthly noise levels of 60-65dB and 65-70dB	4 months
		Night-time	Approximately 30 dwellings on Stephenson St and 10 dwellings on Goodhall Street	Atlas Road satellite compound - general works with typical and highest monthly noise levels of 45-55dB and 50-60dB	66 months
CSV04-C05	Construction noise	Daytime	Approximately 10 dwellings on Old Oak Common Lane and 30 dwellings on Shaftesbury Gardens	Victoria Road north/south widening works and Atlas Road site demolitions and site preparation works with typical and highest monthly noise levels of 60dB and 75dB for properties located on Old Oak Common Lane to the north of Shaftsbury Gardens and 78dB and 80dB for properties located on Shaftsbury Gardens overlooking Victoria Road	20 months (Shaftesbury Gardens) and 61 months (Old Oak Common Lane)
CSV04-C06	Construction noise	Daytime	Approximately 25 dwellings on and close to Midland Terrace	Victoria Road tunnel drive main compound demolition and site set up works and Old Oak Common demolition and site preparation including diaphragm walling with typical and highest monthly noise levels of 55-60dB and 65-70dB	13 months (Old Oak Common works) and 21 months (Victoria Road tunnel drive works)

Significant effect number (see Volume 5 Appendix SV-003-004)	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact
CSV04-C07	Construction noise	Daytime	Approximately 100 dwellings on Wells House Road	Old Oak Common station main compound and Victoria Road tunnel drive main compound works including demolitions with typical and highest monthly noise levels of 60-75dB and 75-80dB	15 months (Victoria Road tunnel drive main compound) and 55 months (Old Oak Common station main compound)
		Evening	Approximately 30 dwellings on Wells House Road	Victoria Road tunnel drive main compound general works with typical and highest monthly noise levels of 55dB and 60dB	15 months
		Night-time	Approximately 40 dwellings on Wells House Road	Victoria Road tunnel drive main compound - general works and Euston tunnel and HS1-HS2 Link tunnel construction work with typical and highest monthly noise levels of 55dB and 60dB	40 to 60 months
CSV04-C08	Construction noise	Daytime	Approximately 175 dwellings on Victoria Road/Chase Road roundabout, North Acton	Victoria Road crossover box main compound demolitions and general works with typical and highest monthly noise levels of 60-65dB and 75dB	23 months

Ground-borne noise and vibration

11.3.16 TBMs will be used to excavate the tunnels. Each TBM is likely to generate ground-borne noise and vibration impacts but only at receptors within a close distance of the centre line of the tunnels and only for short periods of time (a few days). Overall, the deeper the tunnel is, the lower the impact. The perceptible noise and vibration will increase as each TBM approaches and diminish as it moves away from the receptor. Vibration from TBMs will present no risk of any building damage.

11.3.17 The effects of vibration from TBMs on building occupants will be short term (a matter of days) and hence they are not considered to be significant. Proactive and advanced community relations in advance of each TBM passing under properties will help manage expectations and allay possible concerns over the short term presence of vibration.

Residential receptors: indirect effects

11.3.18 Significant noise effects on residential receptors arising from construction traffic are unlikely to occur in this area.

Non-residential receptors: direct effects

11.3.19 Significant construction noise or vibration effects have been identified on a reasonable worst case basis on the following non-residential receptors:

- St. Luke's Church, Kilburn Lane (CSV04-N02). Significant noise effects have been identified during the daytime with noise levels rising at times to around 60 dB over a period of approximately six month commencing in 2018 during the construction of the Salusbury Road vent shaft;
- Blessing Medical Centre, 307 Kilburn Lane (CSV04-N03). Significant noise effects have been identified during the daytime with noise levels rising at times to around 80dB over a period of approximately 21 month commencing in 2018 during the construction of the Salusbury Road vent shaft;
- hostel at Colas Ltd, north entrance, Old Oak Common depot, Old Oak Common Lane (CSV04-N04). Significant noise effects have been identified during the daytime with noise levels rising at times to 65dB over a period of approximately 44 month commencing in 2018 during the construction works at Old Oak Common;
- Holiday Inn Express, Victoria Road, North Acton (CSV04-N05). Significant effects have been identified during the daytime and night-time with noise levels rising to around 75 and 60dB respectively. These effects are forecast to occur over a period of 23 months during the day and 75 months during the night commencing 2017; and
- commercial operations in Boden House (CSV04-N06). Significant effects have been identified during the daytime with noise levels rising at times to around 86dB. These effects are forecast to occur over a period of 21 months during the day.

Non-residential receptors: indirect effects

11.3.20 Significant noise effects on non-residential receptors arising from construction traffic are unlikely to occur in this area.

11.3.21 Cumulative effects from the Proposed Scheme and other committed development

11.3.22 This assessment has considered the potential cumulative construction noise effects of the proposed scheme and other committed developments (see Section 2.1).

11.3.23 There are a number of developments in the area that could result in cumulative construction adverse noise or vibration effects at nearby receptors if they were to be built at the same time as the Proposed Scheme:

- development of residential flats on Salusbury Road;

- further development of the land at the junction of Chase Road and Victoria Road, North Acton; and
- extension of the existing Ramada Hotel to south of the Victoria Road/Chase Road roundabout, North Acton.

11.3.24 There are a number of potentially noise-sensitive committed developments in this area. However, they have been identified on sites where existing sensitive receptors are located. These existing receptors have been considered as part of this assessment and although the committed developments may result in changes to the number of impacts identified no additional significant effects have been identified.

Summary of likely residual significant effects

11.3.25 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it is does not reach a level where it will significantly affect[82] residents.

The measures reduce adverse effects from construction noise outdoors on the majority of residential communities such that they are not considered significant except at the residential communities along the following roads that are closest to the works:

- Salusbury Road vent shaft, dwellings along Albert Road, Rupert Road, Salusbury Road, Kilburn Lane, Claremont Road and Brondesbury Road due to daytime construction activities that are likely to take up to 16 months to complete; and
- Old Oak Common, dwellings along:
  - Stephenson Street and Goodhall Street due to daytime and night-time construction activities at the Atlas Road satellite compound likely to take four months to complete;
  - Old Oak Common Lane and Shaftesbury Gardens due to daytime Victoria Road north/south widening works and works at Atlas Road satellite compound that are likely to take between 20 and 61 months to complete;
  - Midland Terrace due to daytime construction activities at Victoria Road tunnel drive main compound and Old Oak Common station main compound that are likely to take 13 months to complete;
  - Wells House Road due to daytime, evening and night-time construction activities at the Victoria Road tunnel drive main compound and the Old Oak Common station map compound that are likely to take between 15 and 60 months; and
  - Victoria Road/Chase Road roundabout due to daytime construction works at the Victoria Road crossover box main compound that is likely to take 23 months.

11.3.26 On a reasonable worst case basis, noise from specific construction activities has been identified as resulting in significant residual temporary effects on the St Luke's Church

and the Blessing Medical Centre located close to the Salusbury Road vent shaft compound.

11.3.27 Significant residual temporary noise effects have been identified on a worst case basis the Hostel at Colas, Holiday inn Express (Victoria Road) and commercial properties located in Boden House in the Old Oak Common area.

11.3.28 HS2 Ltd will continue to seek all reasonably practicable measures to further reduce or avoid these significant effects. In doing so, HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures. The outcome of these activities will be reflected in the Environmental Minimum Requirements.

11.4 Effects arising during operation

Local assumptions and limitations

11.4.1 The effects of noise and vibration from the operation of the Proposed Scheme have been assessed based on the highest likely train flows, including the Phase Two services. Trains are expected to be 400m long during peak hours and a mix of 200m and 400m long trains at other times.

11.4.2 The expected passenger service frequency for both Phase 1, and Phase 1 with Phase 2 services are described in Volume 1[87]. As a reasonable worst case, this assessment is based upon the service pattern for Monday to Saturday including Phase Two services. Passenger services will start at or after 05:00 from the terminal stations and in this area will progressively increase to the number of trains per hour in each direction on the main lines set out in Table 16. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 16.

Table 16: Train flows and speeds

Description of line	Time period for peak daytime flows	Number of trains per hour in each direction with Phase Two services (Phase One only trains per hour in each direction is set out in brackets)	Speed
Main line between Euston and Old Oak Common	0700 - 2100 hours	18 (14)	230 kph with speeds reducing towards Euston
HS1-HS2 Link	0700 - 2100 hours	3 (3)	230 kph with speed reducing to HS1-HS2 Link Eastern Portal

[87] The change in noise and vibration effects between the different passenger services is assessed in Volume 1.

11.4.3 Tunnel portals are likely to include mechanical ventilation equipment. It is likely that this equipment will only operate for limited testing periods during the daytime[88], or in the event of an emergency.

Avoidance and mitigation measures

11.4.4 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities. This has protected many communities from likely significant noise or vibration effects.

Airborne noise

11.4.5 Significant noise effects from the operational static sources such as mechanical ventilation at tunnel portals and line-side equipment will be avoided through their design and the specification of noise emission requirements (for further information please see Volume 5: Appendix SV-001-000).

Ground-borne noise and vibration

11.4.6 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

Assessment of impacts and effects

Residential receptors: direct effects - individual dwellings

11.4.7 The mitigation measures will reduce airborne noise, ground-borne noise and ground-borne vibration inside all dwellings such that it will not reach a level where it will significantly affect residents.

Residential receptors: direct effects - communities

11.4.8 The avoidance and mitigation measures in this area will avoid ground-borne noise and vibration adverse effects on all residential communities.

Residential receptors: indirect effects

11.4.9 The assessment of operational noise and vibration indicates that significant indirect effects on residential receptors are unlikely to occur in this area.

Non-residential receptors: direct effects

11.4.10 The assessment of operational noise and vibration indicates that significant direct effects on non-residential receptors are unlikely to occur in this area.

Non-residential receptors: indirect effects

11.4.11 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

[88] For example, HS1 vent shaft fans are tested monthly.

Summary of likely significant residual effects

11.4.12 The mitigation measures reduce noise and vibration generated inside all dwellings by the operation of the Proposed Scheme such that it will not reach a level where it will significantly affect residents.

11.4.13 The mitigation measures in this area will also avoid ground-borne noise and vibration adverse effects on all residential communities in this area.

12 Traffic and transport

12.1 Introduction

12.1.1 This section describes the likely impacts on all forms of transport and the consequential effects on transport users arising from the construction and operation of the Proposed Scheme through the Study area.

12.1.2 With regard to traffic and transport, the main issues are changes in traffic and public transport use during construction and operation, particularly in relation to new interchange at Old Oak Common, increased traffic as a result of road diversions, temporary road closures, and temporary substitution or closure of PRoW. The Proposed Scheme will also increase accessibility to rail services from the local area, increase interchange opportunities, increase rail capacity and reduce rail journey times.

12.1.3 The effects on traffic and transport have been assessed quantitatively, based on baseline traffic conditions and future projection scenarios.

12.1.4 A detailed report on traffic and transport and surveys undertaken within the area is contained in Volume 5 Appendix: TR-001-000, Transport Assessment.

12.1.5 Engagement has been undertaken with the key transport authorities including TfL.

12.2 Scope, assumptions and limitations

12.2.1 The assessment scope, key assumptions and limitations for the traffic and transport assessment are set out in Volume 1, and in the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

12.2.2 The study area includes the Salusbury Road area in Kilburn/Queen's Park and the Old Oak Common area as far west as the B4492 Park Royal Road. It also encompasses the east-west running A40 which forms part of the Transport for London Road Network (TLRN).

12.2.3 A number of transport modelling tools have been used to inform the assessment including TfL WeLHAM (West London Highway Assignment Model) for highways and the Railplan model for public transport. The assessment covers the morning (08:00-09:00) and evening (17:00-18:00) peak hours for an average weekday.

12.2.4 The impact of construction traffic has been assessed on the assumption that all excavated material from the work sites will be removed by road for approximately one year and six months prior to implementation of the Willesden Euroterminal railhead and connecting conveyor system (see Section 2.3 for further details). However, investigations will continue to establish the possibility of movement by rail earlier than this.

12.2.5 Utility works in the Salusbury Road area over an extended period precluded detailed traffic and pedestrian surveys. Spot counts and site observations have therefore been undertaken to provide an understanding of the baseline situation.

12.3 Environmental baseline

Existing baseline

12.3.1 Existing traffic and transport conditions in the Study area have been determined through site visits, specially commissioned transport surveys and liaison with TfL and other stakeholders to source transport models and accident data.

12.3.2 Traffic surveys of roads crossing the route or potentially affected were undertaken in June 2012 comprising junction turning counts, automatic traffic counts, traffic signal timing, and journey time surveys. Site observations were also made to review routes used by pedestrians in and around the planned construction worksites.

12.3.3 PRoW and other pedestrian surveys were undertaken in June and September 2012 to establish the nature of the PRoW and their usage by pedestrians and cyclists (non-motorised users). The Proposed Scheme will affect an unrecorded PRoW within the Old Oak Common area, located from the south eastern corner of Wells House Road and connecting with Old Oak Common Lane.

12.3.4 The A40 Western Avenue is the main strategic route in the area and connects the M40 and M25 motorways with central London. It is busy at peak times with delays being experienced at its junctions with Old Oak Common Lane and A4000 Victoria Road. The A406 North Circular Road is located to the west of the area. It connects with the M4 at Chiswick and runs in an orbital route to the east of London via the Hanger Lane Gyratory. To the north of the area, the A404 Harrow road provides access to the Rickmansworth area and A5 Edgware Road. The A4020 passes to the south of the A40 and provides access to junction 1 of the M40 and Shepherd's Bush.

12.3.5 The Old Oak Common area has limited connectivity with the wider highway network (including the A40), due to the severance effect from multiple railway lines, the Grand Union Canal and the congested A40 junctions. .

12.3.6 The main local roads affected by the Proposed Scheme are: the B413 Kilburn Lane which leads to Chamberlayne Road and Kensal Green; Salusbury Road which leads to Brondesbury Park and the B413 Kilburn Lane; Premier Corner which connects B413 Kilburn Lane and Salusbury Road (the junction of the B413 Kilburn Lane/Carlton Road and Salusbury Road is a traffic gyratory); Old Oak Common Lane which connects the A4000 Victoria Road with the A40; the A4000 Victoria Road which leads from the North Acton Gyratory at the A40 to the A404 Harrow Road via A4000 Old Oak Lane; Chase Road which leads from the North Acton Gyratory to North Acton Road and the B4492, Atlas Road which connects with the Old Oak Lane/Victoria Road/Old Oak Common Lane junction; Channel Gate Road which connects with Old Oak Lane;

A4000 Wales Farm Road which connects A4000 Victoria Road to the A40; St. Leonards Road which connects Bethune Road to Chase Road; School Road which connects A4000 Victoria Road with St. Leonards Road and the small enclosed residential area of Wells House Road (located immediately west of the railway depot on Old Oak Common Lane).

12.3.7 In the Old Oak Common area, traffic flows along Old Oak Common Lane are generally light in comparison to both A4000 Victoria Road to the west, Scrubs Lane to the east and the A40 to the south.

12.3.8 Safety and accident data has been obtained from TfL for the three year period from April 2009 - March 2012. No significant accident clusters were identified within the area.

12.3.9 There are four public bus services (Routes 6, 36, 187 and 316) with a combined frequency of up to 40 buses per hour serving the Salusbury Road area providing connections to the City of London, New Cross, Shepherd's Bush, Park Royal, Wembley, Cricklewood and Finchley. A bus stop/stand is located on Claremont Road and is the first stop for Route 36. A single bus stop (B) is located on Premier Corner gyratory.

12.3.10 A single bus service (route 228) operates along the length of Old Oak Common Lane at a frequency of up to five buses per hour in each direction. Bus services 7, 72 and 283 terminate at Brunel Road to the south of Old Oak Common and the GWML.

12.3.11 There are three discrete bridge structures on Old Oak Common Lane. Each is subject to a maximum height restriction of 3.8m and double deck buses are prohibited to travel between the northern and southern sections of Old Oak Common Lane due to the limited headroom.

12.3.12 London Underground and London Overground services are available at Queen's Park station just south of Salusbury Road.

12.3.13 London Underground Central Line services are accessible via East Acton London station to the south of the area and North Acton station to the immediate south and east. The Bakerloo Line is also accessible via Willesden Junction to the north of the area.

12.3.14 London Overground services are also accessible via Willesden Junction, providing connections to Stratford, Richmond, Euston, Watford and Clapham Junction. Local rail services are accessible via Acton Main Line station to the south east providing services between Paddington and Greenford.

12.3.15 Currently the GWML runs from Paddington and passes directly through Old Oak Common rail depot.

12.3.16 Pedestrian crossing facilities in the Salusbury Road area are limited. Utilities works prevented detailed pedestrian surveys at Salusbury Road, but counts of pedestrian entry and exit flows in August 2012 at nearby Queen's Park station suggested that up to 1,000 pedestrians pass through the Salusbury Road gyratory in the weekday morning peak hour period between 08:00-09:00.

12.3.17 The general pedestrian environment in the area of Old Oak Common Lane is poor with narrow footways, limited formal crossing facilities and pedestrians forced to cross the carriageway in order to continue their journey. Surveys indicate that pedestrian flows along Old Oak Common Lane are relatively low. However, pedestrian facilities on A4000 Victoria Road are good.

12.3.18 Old Oak Common Lane is a relatively quiet road recommended by TfL for cyclists and connects to signed cycle routes and A4000 Victoria Road has intermittent sections of mandatory and advisory cycle lanes.

12.3.19 Streets in the vicinity of Salusbury Road are within a controlled parking zone and surveys recorded that parking demand in the area remained within capacity during the busy inter-peak hour of 10:00-11:00.

12.3.20 Surveys indicated that parking demand in the vicinity of Old Oak Common was generally within capacity during the weekday morning period of 10:00-11:00 and weekday demand was generally higher than at weekends.

12.3.21 The closest navigable waterway is the Grand Union Canal which passes within 800m to the south of Salusbury Road and immediately north of the existing Old Oak Common railway depots. Access to the tow path on its southern bank is available at the A4000 Old Oak Common Lane, A219 Scrubs Lane and B450 Ladbroke Grove.

Future baseline

12.3.22 The forecast future baseline traffic volumes have been incorporated within the WeLHAM model for the future construction and operational years of 2021, 2026 and 2041 and into the Railplan model for 2026 and 2041. These include allowance for planned growth based on the London Plan, including any major locally consented schemes. No other changes to the traffic and transport baseline are anticipated in the Study area.

Construction

12.3.23 Construction activities have been assessed against 2021 baseline traffic flows, irrespective of when they occur during the construction period. Future baseline traffic volumes in the peak hours are forecast to grow by typically 2.5 to3.0% by 2021 compared to 2012.

Operation (2026)

12.3.24 Future baseline traffic volumes in the peak hours are forecast to grow by typically 4.5 to5.5% by 2026 compared to 2012.

Operation (2041)

12.3.25 Future baseline traffic volumes in the peak hours are forecast to grow by typically 8.5-9.5% by 2041 compared to 2012.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The following measures (as detailed in Section 2) have been included as part of the engineering design of the Proposed Scheme and will avoid or reduce effects on transport users:

- introduction of a construction railhead at Willesden Euroterminal which will reduce lorry movements on the public highway;
- use of conveyor to transport excavated material to the Willesden Euroterminal that will further reduce HGV movements on the public highway;
- where reasonably practicable road closure will be limited to overnight and/or weekends, although a full closure is required for reconstruction of Old Oak Common Lane bridges;
- maintaining a limited traffic flow (e.g. through one-way or shuttle working) and introducing temporary bridge structures where practicable; and
- HGV routeing as far as reasonably practicable along the strategic road network and using designated routes for access, as shown in Maps TR-03-004b to TR-03-005-L1 (Volume 5, Map Book, Traffic and Transport).

12.4.2 The draft CoCP (see Volume 5: Appendix CT-003-000) includes measures which seek to reduce the impacts and effects of deliveries of construction materials and equipment, including reducing construction lorry trips, especially during peak background traffic periods. The draft CoCP includes HGV management and control measures.

12.4.3 Where reasonably practicable, the number of private car trips to and from the site (both workforce and visitors) will be reduced by encouraging the use of alternative modes of transport or vehicle sharing. This will be supported by an over-arching framework travel plan[89] that will require travel plans to be used, along with a range of potential measures to mitigate the impacts of traffic and transport movements associated with construction of the Proposed Scheme. As part of this, a construction

[89] Construction and operational travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; provision of good cycle and pedestrian facilities; liaison with public transport operators; promotion of car sharing; and the appointment of a travel plan coordinator to ensure suitable measures are in place and are effective.

workforce travel plan will be put into operation with the aim of reducing workforce commuting by private car, especially sole occupancy car travel. This will encourage the use of sustainable modes of transport.

12.4.4 The measures in the draft CoCP will include clear controls on vehicle types, hours of site operation, and routes for HGVs, to reduce the impact of road based construction traffic. In order to achieve this, generic and site specific traffic management measures will be implemented during construction of the Proposed Scheme on or adjacent to public roads, footways and other PRoW affected by the Proposed Scheme, as necessary.

12.4.5 Specific measures include:

- core site operating hours will be 08:00-18:00 on weekdays and 08:00 -13:00 on Saturdays and site staff and workers will therefore generally arrive before the morning peak hour and depart after the evening peak hour (although the assessment has assumed that some of work journeys to the construction sites take place within the morning and evening peak hours which is a reasonable worst case scenario) (draft CoCP, Section 5); and
- excavated material will be reused wherever reasonably practicable along the alignment of the Proposed Scheme which is expected to reduce the effects of construction vehicles on the public highway (draft CoCP, Section 15).

Assessment of impacts and effects

Temporary effects

12.4.6 The following section considers the impacts on traffic and transport and the consequential effects resulting from construction of the Proposed Scheme.

12.4.7 The temporary traffic and transport impacts within the Study area are expected to be:

- construction vehicle movements to/from the construction compounds;
- impacts resulting from road closures and associated diversions;
- removal of parking and loading;
- PRoW and pedestrian route diversions; and
- rail possessions.

12.4.8 Details of construction compounds are provided in Section 2. The duration of when there will be busy transport activity at each site is shown in Table 17: . This represents the periods when the construction traffic flows is expected to be greater than 50% of the peak flows. Also shown is the estimated number of daily vehicle trips during the peak month of activity, the lower end of the range shows the average number of trips in the busy period and the upper end the peak month flows. The assessment scenario

has assumed the peak month for the combination of activities, i.e. not necessarily the peak activity at each individual site.

Table 17: Typical vehicle trip generation for site compounds in this area

Compound type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (years)	Estimated duration with busy vehicle movements (years)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV90	HGV
Main	Salusbury Road vent shaft	Kilburn Lane/ Salusbury Road/Premier Corner	2018	6.5 years	2 years	5-10	75-100
Main	Old Oak Common station	Old Oak Common Lane	2017	9 years	5 years	7-14	105-140
Main	Old Oak Common GWML	Old Oak Common Lane	2021	4 years	2 years	N/A (included in Old Oak Common station trips)	N/A (included in Old Oak Common Station trips)
Satellite	Old Oak Common Lane underbridge	Old Oak Common Lane	2021	4.5 years	2 years	N/A (included in Old Oak Common station trips)	N/A (included in Old Oak Common Station trips)
Satellite	Central line overbridge	Old Oak Common Lane	2021	3.5 years	1.5 years	N/A (included in Old Oak Common station trips)	N/A (included in Old Oak Common Station trips)
Satellite	Atlas Road	Atlas Road	2018	3.5 years	5 years	18-36	270-360
Main	Willesden Euroterminal	Channel Gate Road	2016	7.5 years	2 years	5-10	75-100
Main	Victoria Road crossover box	A4000 Victoria Road, Chase Road and School Road	2017	8 years	2 years	13-26	195-260
Main	Victoria Road tunnel drive	A4000 Victoria Road	2017	4.5 years	3 years	13-26	195-260

12.4.9 Details of the construction phasing are provided in Section 2.3. Construction phasing of works will mean that not all the movements shown in Table 17: will occur at the

[90] Light Goods Vehicles (LGV).

same time and the programme of peak construction works at each site will in practice not be simultaneous.

12.4.10 More than 50% of the movements indicated in Table 17: will be inter-site movements prior to the operation of the conveyor at the Victoria Road crossover box main compound and Willesden Euroterminal main compound.

12.4.11 The main construction works, including road closures and the time periods when each compound is operational are summarised below:

- the six and a half year operational duration of the Salusbury Road compound will not require any road closures but some pedestrian routes will be affected;
- works related to the Old Oak Common Lane underbridge satellite compound will require a temporary full road and footway closure of Old Oak Common Lane for up to one year for road lowering and bridge replacement;
- Bethune Road will be permanently closed as a through route;
- Atlas Road will be temporarily closed to public traffic within the Atlas Road satellite compound boundary for the duration of the works; and
- temporary pedestrian diversions and lane restrictions will be required along A4000 Victoria Road as a consequence of utility works and road widening operations.

12.4.12 In order to assess the different combinations of road closures and construction activity within this area and South Ruislip to Ickenham (CFA6), potential impacts throughout the construction period across CFA4 area have been considered for two distinct temporal phases:

- Scenario CW1 (late 2017-early 2018) with major mass haul underway but the railhead at Willesden not yet fully operational and Old Oak Common Lane (CFA4) still open; and
- Scenario CW2 (2023/2024), railhead operational but Old Oak Common Lane closed (CFA4).

12.4.13 For each scenario, there will be different levels of construction traffic, together with different combinations of road interventions and associated traffic management. However, for assessment purposes it has been assumed that during Scenario CW2 the levels of construction traffic movements will be the same as in CW1 to present a reasonable worst case should closure of Old Oak Common Lane occur before the railhead is fully operational. This is not, however, expected and as such adverse effects are likely to be over-stated.

12.4.14 Construction vehicle movements required to construct the Proposed Scheme will include the delivery of plant and materials, movement of excavated materials and site worker trips.

12.4.15 It is envisaged that the A40 Western Avenue and M25 motorway will provide the primary HGV access and egress routes.

12.4.16 Even with the railhead, a substantial number of inter-site HGV movements will occur such as those between the tunnel lining casting and storage yard at the Atlas Road satellite compound, the Victoria Road crossover box main compound and Old Oak Common station main compound.

12.4.17 No traffic diversions are expected from construction of the Proposed Scheme at Salusbury Road.

12.4.18 A full road closure on Old Oak Common Lane for 12 months will require traffic to be restricted to local access only and a 3.5km diversion to be introduced for general traffic, generally be via A4000 Victoria Road/A4000 Wales Farm Road and the A40. This will constitute a major adverse effect.

12.4.19 Full closure of Bethune Road will require traffic diversions but these will not be significant.

12.4.20 Utilities works (including diversions) have been considered in detail where works are expected to be major and where the traffic and transport impacts from the works separately, or in combination with other works, is greater than other construction activities arising within the area. More minor utilities works and associated traffic management measures will have only localised impacts and are expected to short-term in duration. Utilities works are not expected to result in significant additional adverse effects.

12.4.21 During the peak activity period, vehicle movements at Salusbury Road are not expected to exceed 100 vehicles in total (combined in/out movements) per day/per site. These will be mostly HGVs but they will be small in comparison to the wider area traffic flows. These changes in traffic will not have significant effects.

12.4.22 In the Old Oak Common area during the busiest month, approximately 360 construction vehicle movements (inbound/outbound) per day traffic movements will be generated associated with the Atlas Road compound. These will be mostly HGVs.

12.4.23 Construction of the Proposed Scheme will result in changes in traffic flows and delays to vehicle users in the area due to increased traffic flows from construction activity in addition to diversionary effects from a closure of Old Oak Common Lane.

12.4.24 The changes in traffic flows are expected to lead to increases in congestion[91] and delays at junctions in the following locations:

[91] In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows at a junction will be beyond or very close to capacity with the Proposed Scheme and the increases in traffic due to the Proposed Scheme will be such as to substantially increase queues and delays on a routine basis at peak times. A moderate adverse effect will occur when traffic flows at a junction will be approaching or at capacity with the Proposed Scheme and modest increases in traffic will increase the frequency of queues and more substantial

- Tubbs Road/Nightingale Road junction - minor adverse effect (in scenario CW2);
- A40 Western Avenue/Savoy Circus - minor adverse effect (in scenario CW2); and
- Old Oak Common Lane/Savoy Circus - major adverse effect (in scenario CW2).

12.4.25 There are no significant congestion effects expected for scenario CW1. As a result of construction traffic movements, road closures and /or traffic diversions in both scenarios CW1 and CW2, construction of the Proposed Scheme is expected to result in increases in daily traffic flow causing a significant increase in traffic-related severance[92] in the following locations:

- Old Oak Common Lane between A4000 Old Oak Lane and Wells House Road - moderate adverse effect (HGV increase in scenario CW1);
- A4000 Victoria Road between A4000 Wales Farm Road and Atlas Road - major adverse effect (HGV in scenarios CW1 and CW2);
- Channel Gate Road - moderate adverse effect (HGV in scenarios CW1 and CW2);
- Atlas Road - major adverse effect (HGV in scenarios CW1 and CW2);
- A4000 Wales Farm Road - major adverse effect (HGV in scenarios CW1 and CW2);
- St. Leonard's Road - minor adverse effect (all vehicles in scenario CW2); and
- Bishop's Bridge Road - moderate adverse effect (HGV in scenario CW2).

12.4.26 Some of the effects listed above will extend across CFA boundaries, and where this is the case they are also identified and reported within those areas.

12.4.27 Unless separately identified, these changes in traffic levels will not have significant effects on congestion.

12.4.28 During full closure of Old Oak Common Lane, an approximate 3.5km diversion of bus route 228 will be required via A4000 Victoria Road, A4000 Wales Farm Road, A40 Western Avenue and other local roads. This will constitute a major significant effect. The existing bus depot facilities located off Atlas Road will remain in operation within the Atlas Road compound. No significant impact on public transport is expected as a result.

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delays. A minor adverse effect occurs when traffic flows at a junction are not generally exceeding capacity with the Proposed Scheme but the increase in flows will result in occasional queues and delays or small increases in existing delays.

[92] In the context of this Traffic and Transport section, Severance is used to relate to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for non-motorised users to cross. A reference to severance does not imply a route is closed to access.

12.4.29 The Salusbury Road vent shaft main compound will require the relocation of a bus stop on Premier Corner and a bus stop on Claremont Road. It is expected that the distances to the replacements will be, respectively, some 100-200m, representing a moderate adverse effect and over 400m constituting a major adverse effect. No other significant effects are expected to public transport in the Salusbury Road area.

12.4.30 The relocation of bus stops from Old Oak Common Lane to the diversion route will constitute a major adverse effect as they will be located over 400m from the original locations resulting in increased walking time for passengers. However mitigation measures to maintain bus routes and limit full closures as far as reasonably practicable will be investigated at the detailed design stage. Construction of the Proposed Scheme will have a number of impacts on parking. In particular:

- during the construction phase, a doctors parking space on Claremont Road at Salusbury Road will be lost, but it is assumed that re-provision will be within a convenient distance on Claremont Road and this will not be a significant effect;
- the redevelopment of Salusbury Road car park to provide the vent shaft will lead to the loss of up to 40 parking spaces, including one disabled car parking space, constituting a major adverse effect; and
- approximately 1,000 private off-street parking spaces in the Park Royal area will be lost during the construction of the Proposed Scheme. However, since the developments associated with the parking will also be removed this will not be significant.

12.4.31 The effect on accident and safety risks will not be significant. There are no locations with existing highway safety issues where there will be substantial increases in traffic during construction.

12.4.32 The closure of the Premier Corner western footway and northern Kilburn Lane footway adjacent to the construction compound will involve a short diversion increasing travel distance, but this is not significant.

12.4.33 The permanent closure of Bethune Road will require a pedestrian and cycle diversion via School Road, St. Leonard's Road and the new link connecting St. Leonard's Road and Chase Road, constituting a minor adverse effect.

12.4.34 The full closure of Old Oak Common Lane and simultaneous closure of the unrecorded PRoW connecting Wells House Road to Old Oak Common Lane will require a pedestrian and cycle diversion of up to 3.5km to be introduced. This will be a major adverse effect.

12.4.35 Construction of the Proposed Scheme will require the permanent removal of access to the Acton and Northolt Line from the Old Oak Common area. This is considered in Section 12.5 under operations effects.

12.4.36 In the Old Common area there will be no significant effects on London Underground, London Overground or National Rail stations as a direct result of construction works.

12.4.37 However, rail possessions and temporary blockades are expected to be implemented in order to accommodate civil engineering works. These are expected to be mostly midweek overnight and weekend possessions, with one long weekend possession.

12.4.38 These rail possessions are not expected to have significant effects on users.

12.4.39 No effects are anticipated on the Grand Union Canal during construction of the Proposed Scheme.

12.4.40 Construction works at Old Oak Common will displace the HEx and FGW depots. This is discussed further in Volume 4.

Cumulative effects

12.4.41 The assessment includes the cumulative effects of planned development during construction by taking this into account within the background traffic growth.

12.4.42 The assessment also includes in-combination effects by taking into account traffic and transport impacts of works being undertaken in neighbouring CFA areas. Specifically, the assessment includes the construction traffic associated with the Euston area (CFA1), the Camden Town and HS1 Link area (CFA2) and the South Ruislip to Ickenham area (CFA6). However, these effects are confined to a small increase in traffic on the strategic A40 Western Avenue.

Permanent effects

12.4.43 Any permanent construction effects have been considered in the operations phase assessments for traffic and transport in Section 12.5. This is because the impacts and effects of the forecast increases in travel demand and the wider impacts and effects of the operation phase need to be considered together.

Other mitigation measures

12.4.44 The implementation of the draft CoCP (see Volume 5: Appendix CT-003-000) in combination with the construction workforce travel plan will, to some degree, mitigate the transport related effects during construction of the Proposed Scheme. The reductions in effects arising from the travel plan measures have not been included in the assessment which will mean that the adverse effects may be over-stated.

12.4.45 A number of signalised junctions in this area are under what is known as adaptive control which will optimise the signals to minimise delays due to changes in traffic flows. Consequently, many of those junctions with an identified minor adverse effect will be mitigated through adaptive control, although this less effective where there is an overall increase in traffic.

12.4.46 Rail replacement services will be provided where necessary when rail possessions are in place.

12.4.47 Based on the outcomes of this assessment, no further traffic and transport mitigation measures during construction of the Proposed Scheme are considered necessary.

Summary of likely residual significant effects

12.4.48 The magnitude and significance of construction impacts and effects will vary according to the specific scenario. Changes in traffic flows related to construction traffic and diversions associated with the Proposed Scheme will lead to congestion, increasing delays for road users on Tubbs Road/Nightingale Road; A40 Western Avenue/Savoy Circus; and Old Oak Common Lane/A40 Savoy Circus.

12.4.49 Traffic diversions due to the temporary full road closure of Old Oak Common Lane and permanent closure of Bethune Road will result in increased travel distance for all road users

12.4.50 Increases in traffic flows due to diversions and construction traffic will make it more difficult for non-motorised users to cross the road along some sections of Old Oak Common Lane; A4000 Victoria Road; Channel Gate Road; Atlas Road; A4000 Wales Farm Road; St. Leonards Road; and Bishops Bridge Road.

12.4.51 There will be only limited effects at the Salusbury Road vent shaft main compound relating to changes to bus stop arrangements, loss of parking provision and pedestrian diversions.

12.4.52 The significant effects that result from construction of the Proposed Scheme are shown in Maps TR-03-004b, TR-03-004b-L1, TR-03-005 and TR-03-005-L1 (Volume 5, Map Book, Traffic and Transport).

12.5 Effects arising from operation

Avoidance and mitigation measures

12.5.1 The following measures have been included as part of the Old Oak Common Station design of the Proposed Scheme and will avoid or reduce impacts on transport users:

- station design sized to include sufficient concourse and platform space to accommodate passenger growth to 2041 and beyond (including HS2 Phase Two demands);
  - station design includes the following transport facilities as shown on TR-01-012 (Volume 5, Traffic and Transport Map Book):
  - interchange offering access to key rail routes including Crossrail and HS2;
  - dedicated bus facilities;
  - dedicated taxi facilities;

  - dedicated drop-off and pick-up areas; and
  - pedestrian and cycle facilities and links.
- two station access routes via Old Oak Common Lane;
- significantly upgraded highway infrastructure serving the new station. This will include new and improved traffic signalised junctions and bus stops on Old Oak Common Lane and A4000 Victoria Road as well as widened carriageways and improved headroom clearance to allow full height bus operations under the reconstructed Old Oak Common Lane bridges; and
- new infrastructure to provide for substantial bus service frequency improvements.

12.5.2 The framework travel plan will set out how travel plans will be used to mitigate the impacts of traffic and transport movements associated with the maintenance and operation of the Proposed Scheme. This will require a station travel plan to be in place help reduce any traffic impacts in this area, in particular by promoting the use of sustainable modes by both workers and passengers.

Assessment of impacts and effects

12.5.3 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the Proposed Scheme (as described in Section 2.4 of this report).

12.5.4 The operation traffic and transport impacts with this CFA are:

- increase in rail capacity between London and Birmingham;
- reduced travel times to Proposed Scheme destinations;
- the new interchange and direct access to the GWML and Crossrail;
- passenger demands to/from the new Old Oak Common station together with the impacts on public transport and highways;
- highway improvements that facilitate improved bus operation;
- loss of parking at Salusbury Road; and
- permanent closure of Bethune Road.

12.5.5 The new station at Old Oak Common creates direct access to the surrounding area, including bus, taxi, car drop-off and walking and cycling links. However, the most important role is in providing interchange between rail services. While created to provide a new station and interchange for the Proposed Scheme's services, it will also create a new local station and an important interchange between services operating on the GWML to both local and longer distance (GWML) destinations, Crossrail services and HS2 services. The use of Old Oak Common by HS1 services provides additional linkages.

12.5.6 Table 18 and Table 19 show the expected arrivals and departures and pattern of interchange for the 2026 and for the 2041 with Phase Two services for the AM peak hour respectively.

Table 18: Old Oak Common station 2026 AM peak hour rail-rail interchange and station exit/access passenger flows including HS1

Departure route **Arrival Route**	**Crossrail and GWML Local services**	**GWML Fast Services**	**HS2**	**HS1**	**Station exit (bus and walk)**	**Totals**
Crossrail and GWML Local services	2,566	1,845	981	221	753	6,367
GWML Fast services	5,140	141	337	250	287	6,155
HS2	2,111	299	0	528	154	3,093
HS1	215	250	528	0	108	1,101
Station access (bus and walk)	617	104	269	101	0	1,091
Totals	10,650	2,640	2,115	1,100	1,302	17,806

Table 19: Old Oak Common station 2041 AM peak hour rail-rail interchange and station exit/access passenger flows including HS1

Departure route **Arrival Route**	**Crossrail and GWML local services**	**GWML Fast Services**	**HS2**	**HS1**	**Station exit (bus and walk)**	**Totals**
Crossrail and GWML Local Services	2,937	2,192	2,192	221	819	8,361
GWML Fast Services	6,520	146	819	250	332	8,067
HS2	3,115	822	0	528	328	4,793
HS1	215	250	528	0	108	1,101
Station access (bus and walk)	610	118	569	101	0	1,398
Totals	13,397	3,528	4,108	1,100	1,586	23,720

12.5.7 These tables illustrate the patterns of interchange through the station. Total arrivals on HS2 services account for less than 20% of users of the station in both 2026 and 2041, with departures some 12% of total departures in 2026 increasing to 17% in 2041. Users of GWML fast services make up some 35% of arrival in both 2026 and 2041 and 15% of departures. There is a high level of interchange between GWML services and Crossrail because Old Oak Common provides an easy and convenient link between the two. This will in turn reduce pressure on Paddington station.

12.5.8 Table 20 shows the number of people travelling by each non-rail mode of transport to/from Old Oak Common station for the AM peak hour. Car, including kiss and ride,

and taxi access are not covered in Table 18 and 19. These have been assessed and are included in the table below.

Table 20: Approximate Old Oak Common Station person trips per mode

Demand/mode	2026 Phase One	2041 Phase Two
	AM peak hour	AM peak hour
	Boarders/Alighters	Boarders/Alighters
Approximate Total Passengers Through Front Door	2,700	3,360
Car (short-stay parking)	<10	<15
Taxi	105	140
Motorcycle	50	50
Bus	1,300	1,620
Walk/Cycle	1,030	1,300
Kiss and Ride	190	235
Rail-rail interchange inc. HS1	15600	21500

12.5.9 With the introduction of the Proposed Scheme in 2026, there will be approximately 2,700 rail passengers entering or leaving the station to or from trains in the morning peak hour and around 1,990 in the evening peak hour.

12.5.10 In 2041 with Phase Two, these numbers will increase to approximately 3,360 passengers entering or leaving the station to or from trains in the morning peak hour and approximately 2,500 passengers in the evening peak hour.

12.5.11 In 2026, these passengers are forecast to generate around 235 two way vehicle flows (i.e. total of both inbound and outbound trips) in the morning peak hour (08:00-09:00) and 180 two way vehicles in the evening peak hour (17:00-18:00). In 2041, these passengers are forecast to generate around 300 two way vehicle flows in the morning peak hour and 225 two way vehicles in the evening peak hour. These vehicle trips represent only some 1.5% of total users of the station (or 11.5% of passengers through the station front door) and small in relation to overall traffic levels.

12.5.12 In terms of surface access the distribution of origins and destinations of the bus passenger, taxi and car trips accessing Old Oak Common station are forecast to be broadly balanced to north, south, east and west, with a slight emphasis on westbound and southbound travel.

12.5.13 The Proposed Scheme will provide a substantial increase in rail capacity and improved journey times between and London and the West Midlands and destinations to the north. This will represent a major beneficial effect to both local users and travellers from the wider area that find Old Oak Common station a convenient access point to

the Proposed Scheme services. (With the introduction of Phase Two, the new links to Manchester and Leeds will result in further journey time and capacity benefits to these and intermediate stations).

12.5.14 The Proposed Scheme also provides local access to the GWML and Crossrail (including its links to Heathrow Airport) and this new access opportunity will substantially improve local accessibility and represents a major beneficial effect. The incorporation of full accessibility for mobility impaired users is a further moderate beneficial effect.

12.5.15 In addition to local access, the new station provides an important interchange to make travel in west London easier, which is evidenced by the very high interchange not just to the Proposed Scheme services but also between the GWML and Crossrail. This is major beneficial effect.

12.5.16 For the longer term, the development aspirations in the wider Old Oak Common area is critically dependent upon high quality, accessible public transport and the creation of the Old Oak Common interchange provides the potential for major beneficial effects should these developments come forward.

12.5.17 The Proposed Scheme will include bus facilities at Old Oak Common station and new interchange opportunities. Reconstructed bridges over Old Oak Common Lane will permit the passage of double deck buses along the full length of Old Oak Common Lane, improving connectivity and allowing new and expanded routes to be introduced. It is expected that the majority of bus users will be to and from the south of the station gaining particular benefits from the improved access and the potential for improved services to the wider area. This is considered a moderate beneficial effect.

12.5.18 The Proposed Scheme includes the realignment and/or reconfiguration of highways around Old Oak Common station. Specifically, this will include: widening and realignment of Old Oak Common Lane; widening of A4000 Victoria Road; and reconfiguration of the Old Oak Common Lane and A4000 Victoria Road junctions with the A40. With these highway capacity improvements in place, delays and queues will be similar to those forecast without the Proposed Scheme in both 2026 and 2041.

12.5.19 The increases in traffic as a result of the Proposed Scheme are almost entirely access trips to and from Old Oak Common station. Although occasional traffic may access areas of the Proposed Scheme for maintenance and servicing purposes, these infrequent vehicle movements that will be very low and taken in isolation, will therefore have no significant effect.

12.5.20 In 2026, the impact of traffic accessing Old Oak Common station is primarily on local roads leading to and from the station with some onward movements on the strategic network. Due to the relatively low number of vehicle movements on routes that are close to capacity, there are few significant adverse effects. However, during both the morning and evening peak hours, they will cause significant in congestion

and delays, resulting a minor adverse effect at the Old Oak Common Lane/Du Cane Road junction.

12.5.21 The Proposed Scheme, is expected to result in significant increases in peak hour traffic flows of more than 10% in 2026 on the road network local to Old Oak Common Station causing an increase in traffic-related severance for non-motorised users in the following locations:

- Barlby Road - moderate adverse effect;
- A4000 Old Oak Lane - major adverse effect;
- St. Mark's Road - major adverse effect;
- A219 Shepherds Bush Road - moderate adverse effect;
- A40 A219 Wood Lane on-slip - major adverse effect;
- Cambridge Gardens - moderate adverse effect;
- B412 Westbourne Park Road - moderate adverse effect;
- Old Oak Common Lane - major adverse effect;
- A4000 Victoria Road - moderate adverse effect;
- Du Cane Road - major adverse effect;
- Chase Road - moderate adverse effect;
- A219 Wood Lane - major adverse effect; and
- Sussex Gardens - moderate adverse effect.

12.5.22 In 2041, during the morning and evening peak hours, increases in traffic as a result of the Proposed Scheme are expected to result in an increase in congestion and delays at the following locations in addition to those shown for 2026:

- Old Oak Common Lane/Du Cane Road junction - moderate adverse effect;
- Old Oak Common Lane/A40 junction - moderate adverse effect;
- Old Oak Common Lane/A4000 Old Oak Lane/Atlas Road - minor adverse effect;
- Acton Lane/Mordaunt Road - minor adverse effect; and
- Acton Lane/North Acton Lane - minor adverse effect.

12.5.23 The Proposed Scheme, is expected to result in significant increases in peak hour traffic flows in 2041 causing an increase in traffic-related severance for non-motorised users at the following locations in addition to those shown for 2026:

- East Churchfield Road - major adverse effect; and
- A4000 Wales Farm Road - moderate adverse effect.

12.5.24 It is expected that any changes in traffic on strategic routes in the vicinity of Old Oak Common station (for example M25 and A40) will not be significant. There will be the loss of all of the former public car parking spaces at Salusbury Road during the operational phase and will constitute a major adverse effect.

12.5.25 The effect on accidents and safety is not significant as there are no locations where there are existing highway safety issues. Indeed, it is expected that the improvements to the highway network and provisions for pedestrians and cyclists included in the Proposed Scheme will be likely to offset any impacts of increased traffic.

12.5.26 The Salusbury Road footway lost during construction will be reinstated. The Proposed Scheme will have no significant impact on the Wells House Road PRoW. At Old Oak Common the Proposed Scheme will incorporate dedicated pedestrian and cycle facilities and upgrade facilities along Old Oak Common Lane, which will be a minor beneficial effect.

12.5.27 Bethune Road will be permanently closed and incorporated into the Permanent Scheme constituting a minor significant adverse effect for non-motorised users due to increased travel distances.

12.5.28 The Proposed scheme involves removal of access to the Acton and Northolt rail line. However, there are alternatives to this link and potential routes to access the retained section beyond Old Oak Common. This is not considered a significant effect.

12.5.29 No permanent changes or effects are expected to be made to the navigability or course of the Grand Union Canal.

Cumulative effects

12.5.30 The assessment includes the cumulative effects of planned development during operation by taking this into account within the background traffic growth.

12.5.31 The assessment considers in-combination effects by taking into account transport impacts as a result of the Proposed Scheme in neighbouring CFA areas. However, for this area, there are no effects from neighbouring CFAs expected.

Other mitigation measures

12.5.32 The travel plan for Old Oak Common station will, to some degree, mitigate the transport related effects during operation of the Proposed Scheme by promoting the use of sustainable modes by both workers and passengers. The reductions in effects arising from the travel plan measures have not been included in the assessment, which will mean that the adverse effects may be over-stated.

12.5.33 The strategy and opportunities for providing bus connections to the Old Oak Common station will be explored with TfL and the relevant borough councils nearer to the year of opening, as the existing bus service provision in the local area, upon which the

re-routeing of services will be based, is likely to change in the intervening 15 year period.

12.5.34 No further mitigation measures for the operation of the Proposed Scheme are considered necessary based on the outcomes of this assessment.

Summary of likely significant residual effects

12.5.35 The opening of the proposed station at Old Oak Common will provide substantial transport accessibility improvements for local users and travellers from the wider area to the HS2, GWML and Crossrail services. There will be a major beneficial effect on rail capacity and improved journey times between London and Birmingham and stations to the north of Birmingham. Further interchange benefits will be obtained through local access to, and interchange between, GWML and Crossrail.

12.5.36 The high quality improvements in transport provision will also provide the opportunity to support local development aspirations for the longer term.

12.5.37 Reconstruction of the railway bridges on Old Oak Common Lane will permit the passage of double deck buses, allowing for expanded destinations and improved bus frequencies, conferring further benefits to local users. There will be local pedestrian and cycle improvements and the station will also be provided with dedicated taxi facilities.

12.5.38 An uplift in the number of vehicular and non-vehicular trips to and from the Old Oak Common area upon introduction of the Proposed Scheme is expected. The associated traffic impacts will be mitigated through the Proposed Scheme's highway capacity improvements to roads in the vicinity of the proposed Old Oak Common station.

12.5.39 Changes in traffic flows will lead to congestion, increasing delays at Old Oak Common Lane/Du Cane Road; Old Oak Common Lane/A40 junction; Old Oak Common Lane/A4000 Old Oak Lane/Atlas Road; Acton Lane/Mordaunt Road; and Acton Lane/North Acton Lane

12.5.40 Changes in traffic flows will make it more difficult to cross the road at Barlby Road; A4000 Old Oak Lane; St. Mark's Road; A219 Shepherds Bush Road; A40 A219 Wood Lane on-slip; Cambridge Gardens; B412 Westbourne Park Road; Old Oak Common Lane; A4000 Victoria Road; Du Cane Road; Chase Road; A219 Wood Lane; Sussex Gardens; East Churchfield Road; and A4000 Wales Farm Road.

12.5.41 There will be a permanent closure of Bethune Road and the land will be incorporated into the Permanent Scheme.

12.5.42 Operational effects at Salusbury Road will be limited to a permanent loss of around half of the car parking provision at Salusbury Road Car Park.

12.5.43 The significant effects that will result from the Proposed Scheme are shown in Maps TR-04-004B, TR-04-004B-L1 and TR-04-005 and TR-04-005-L1 (Volume 5, Traffic and Transport Map Book).

13 Water resources and flood risk assessment

13.1 Introduction

13.1.1 This section provides a description of the current baseline for water resources including surface water, groundwater and the baseline conditions for flood risk. It then reports on the likely impacts and significant effects on these aspects as a result of the construction and operation of the Proposed Scheme.

13.1.2 The main environmental feature of relevance to water resources and flood risk is the Grand Union Canal (Uxbridge to Hanwell Locks, Slough Arm, and Paddington Arm).

13.1.3 The key environmental issues relating to water resources and flood risk include:

- the potential risk to surface water quality due to widespread construction activity including the transfer of construction and excavated materials over the Grand Union Canal (Paddington Arm);
- the residual risk of flooding due to the potential for tunnelling to result in ground settlement which in turn may potentially result in a breach of the existing retaining structures of the Grand Union Canal (Paddington Arm) at Old Oak Common. Water levels in the canal are up to 4.5m higher than surrounding ground levels; and
- potential impacts on the risk of surface water flooding at the Salusbury Road vent shaft, Old Oak Common station, Victoria Road bridge and the Victoria Road crossover box.

13.1.4 Volume 5: Appendix WR-001-000 contains a report on the route-wide effects including:

- generic assessments on a route-wide basis;
- stakeholder engagement;
- in-combination effects;
- a draft operation and maintenance plan for water resources and flood risk;
- a WFD[93] compliance assessment; and
- a route-wide flood risk assessment (FRA).

13.1.5 Detailed reports on water resources and flood risk within this area are also contained in the Volume 5 Appendices. These include:

[93] Water Framework Directive, *Directive 200/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy*, Strasbourg, European Parliament and European Council.

- Volume 5: Appendix WR-002-004: Water Resources Assessment report;
- Volume 5: Appendix WR-003-004: Flood Risk Assessment; and
- Volume 5: Appendix WR-004-001: Hydraulic modelling report for a breach of the Grand Union Canal (Paddington Branch) at Old Oak Common.

13.1.6 Map Series WR-01 to WR-03 showing some of the details, environmental baseline and design features referred to in this report and those in Volume 5 are all contained in the Volume 5, Water Resources and Flood Risk Assessment Map Book.

13.1.7 Consultation has been undertaken with the Environment Agency, Thames Water Utilities and the Canal & River Trust (formerly British Waterways).

13.2 Scope assumptions and limitations

13.2.1 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are set out in Volume 1, Section 8, and in the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum(see Volume 5: Appendix CT-001-000/2)). This report follows the standard assessment methodology.

13.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this spatial scope is defined as the study area.

13.2.3 Water Framework Directive (WFD) classification data has been made available by the Environment Agency. For surface water bodies that do not have a WFD status class shown in the relevant River Basin Management Plan (RBMP), the status class has been taken as the status class for the first downstream water body for which a status class is reported. Where groundwater does not have a WFD status class shown in the relevant RBMP, these are referred to as 'not assessed by the Environment Agency'.

13.2.4 A site visit was undertaken to the Grand Union Canal to inform the assessment of flood risk from this water body.

13.2.5 Limited data are available with regard to surface water quality and no additional surveys were carried out for this assessment.

13.2.6 A reasonable understanding of conditions likely to be encountered in below ground construction is available from existing sources documenting the geology and hydrogeology of the study area and groundwater level data from the Environment

Agency. No monitoring of groundwater levels was undertaken as part of this assessment.

13.2.7 The current assessment draws on existing information gathered from the Environment Agency, British Geological Survey, the Canal & River Trust and the relevant Lead Local Flood Authorities (LLFA). Information from the LLFA strategic flood risk assessment[94], preliminary flood risk assessment[95] (PFRA) reports and condition survey reports of the Grand Union Canal has been used as context to provide baseline data for the assessment of flood risk within this study area.

13.3 Environmental baseline

Existing baseline - surface water resources

Surface water features

13.3.1 The study area lies within the Thames River Basin District and is covered by the associated RBMP[96]. Surface water features include the Grand Union Canal (Uxbridge to Hanwell Locks, Slough Arm, and Paddington Arm) and several un-named small ponds. The route will pass beneath the Grand Union Canal (Paddington Arm) in tunnel. The canal runs adjacent to the route between Kensal Green Cemetery and Mitre Bridge as shown on Map WR-01-004, E6 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

13.3.2 The current surface water baseline is shown on Map WR-01-004 (Volume 5, Water Resources and Flood Risk Assessment Map Book) and all surface water features within the study area are assessed within Volume 5: Appendix WR-002-004. Table 21 includes features potentially affected by the Proposed Scheme.

Table 21: Summary of surface water features in the study area

Water feature	Location description (and map reference)[97]	Watercourse classification[98]	WFD water body and current overall status	WFD status objectives (by 2015 as in RBMP)	Receptor value[99]
Grand Union Canal Branch (Paddington Arm)	Will be crossed by the route near St. Mary's Roman Catholic	Artificial	Grand Union Canal (Uxbridge to Hanwell Locks, Slough Arm,	Good potential	High

[94] Jacobs (2007), *London Borough of Brent Strategic Flood Risk Assessment*. Capita Symonds (2008), *London Borough of Ealing Strategic Flood Risk Assessment*.
[95] Hyder/AECOM (2011), *London Borough of Brent Preliminary Flood Risk Assessment*. Capita Symonds (2011), *Ealing Council Preliminary Flood Risk Assessment*.
[96] Environment Agency (2009), *River Basin Management Plan, Thames River Basin District*.
[97] See Volume 5, Water Resources and Flood Risk Assessment Map Book.
[98] Water-feature classifications: Section 113 of the Water Resources Act 1991 defines a Main river as a watercourse that is shown as such on a Main river map. Section 72 of the Land Drainage Act 1991 defines an Ordinary watercourse as 'a watercourse that is not part of a Main river'. Section 221 of the Water Resources Act 1991 defines a watercourse as including 'all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. Main rivers are larger rivers and streams designated by Defra on the Main river map and are regulated by the Environment Agency. *Water Resources Act 1991*, London, Her Majesty's Stationery Office. *Land Drainage Act 1991*. London, Her Majesty's Stationery Office.
[99] For examples of receptor value see Table 43 in the Addendum to the SMR.

Water feature	Location description (and map reference)[97]	Watercourse classification[98]	WFD water body and current overall status	WFD status objectives (by 2015 as in RBMP)	Receptor value[99]
	Cemetery, College Park (SWC-CFA4-01, Map WR-01-004)		Paddington Arm) Moderate		

Water Framework Directive status

13.3.3 Within this study area the Grand Union Canal (Uxbridge to Hanwell Locks, Slough Arm, and Paddington Arm) is the only water body given a WFD classification by the Environment Agency. It is designated as an artificial water body with a current overall status of 'Moderate'.

Abstraction and permitted discharges

13.3.4 There are no licensed or unlicensed surface water abstractions within the study area[100]. There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m^3 per day. Details are presented in Volume 5: Appendix WR-002-004. The abstractions are classified as high value receptors.

13.3.5 The Environment Agency reports that there are no active surface water discharge consents within 500m of the route.

Existing baseline - groundwater resources

Geology and hydrogeology

13.3.6 The location of abstractions, geological formations and indicative groundwater levels are shown in Map WR-02-004 (Volume 5, Water Resources and Flood Risk Assessment Map Book) and geological formations are shown in long profile in Volume 5: Appendix WR-002-004.

13.3.7 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 22. Unless otherwise stated, the geological groups listed are all crossed by the route.

[100] Surface water abstractions for public supply are not included.

Table 22: Summary of geology and hydrogeology in the study area

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objectives (by 2027 in RBMP)	Receptor value
Superficial deposits						
Thames Catchment Subgroup (Maidenhead Formation, Langley Silt Member)	Outcrops approximately 800m south of the route in the southern part of the study area. (will not be penetrated by the Proposed Scheme)	Clay and silt	Unproductive strata	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Low
Bedrock						
Thames Group (London Clay Formation and Harwich Formation)	Across entire area (will be crossed by route)	Sandy, silty clay	Unproductive	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Not assessed by the Environment Agency
Lambeth Group (Upnor, Reading and Woolwich Formations)	Assumed to underlie London Clay Formation throughout the area (will not be penetrated by the Proposed Scheme)	Lenses and interbedded layers of clay, silty sand and shelly silty clay at the top, sand and gravel towards the base	Unproductive (top)/ Secondary A (base)	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Low (top) Moderate (base)
Thanet Sand Formation	May underlie Lambeth Group, although may be absent from this study area (will not be penetrated by the Proposed Scheme)	Green, brown silty sand	Secondary A	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
White Chalk Subgroup	Assumed to underlie Lambeth Group/Thanet Sand Formation throughout the area (will not be penetrated by the Proposed Scheme)	Firm white chalk with marl seams and flint bands	Principal	Mid-Chilterns Chalk (GB40601G601200) Poor	Good	High (no SPZ will be crossed)

Superficial deposits

13.3.8 Geological mapping indicates that there are no superficial deposits present on or within 250m of the Proposed Scheme in the area. The nearest superficial deposits comprise the Langley Silt Member of the Maidenhead Formation which is present in the southern part of the study area, approximately 800m south of the route.

Bedrock aquifers

13.3.9 The London Clay Formation underlies the whole of the study area: this is a blue-grey clay that weathers to a brown colour in its upper part.

13.3.10 The geological succession beneath the London Clay Formation comprises, in turn:

- the Harwich Formation, a thin sandy deposit (at least locally);
- the Lambeth Group (also termed the Woolwich and Reading Formations) which comprises mixed sands and clays and pebble deposits locally;
- the Thanet Sand Formation, a dense green sand; and
- the White Chalk Subgroup, which is a succession of soft white limestones.

Water Framework Directive status

13.3.11 No WFD classification has been given by the Environment Agency to the superficial deposits.

13.3.12 The London Clay Formation is classed as unproductive strata, and as such has not been classified under the WFD.

13.3.13 The White Chalk Subgroup forms part of the Mid-Chilterns Chalk groundwater body. The current overall status of the Mid-Chilterns Chalk is Poor with an objective to reach Good status by 2027.

Abstractions and permitted discharges

13.3.14 No groundwater SPZ for public water supplies will be crossed by the Proposed Scheme in this study area.

13.3.15 The Environment Agency reports that there are four licensed groundwater abstractions within the study area. There is the potential for unlicensed abstractions to be present, as a licence is not required for abstraction volumes below 20m^3 per day however none have been identified within the study area. Details are presented in Volume 5: Appendix WR-002-004. The abstractions are classified as high value receptors.

Surface water/groundwater interaction

13.3.16 The assessment has not identified any issues relating to surface water/groundwater interactions within 500m of the route centre line in this study area.

Water dependent habitats

13.3.17 The route does not cross any areas with statutory ecological designations in relation to water.

Existing baseline - flood risk

River flooding

13.3.18 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping, as shown on Map WR-01-004 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

13.3.19 The route will not cross any designated main rivers or ordinary watercourses within this study area, as identified using the Detailed River Network[101]. The entire study area is within Flood Zone 1, i.e. there is a low risk of flooding.

Surface water flooding

13.3.20 All PFRA reports state that the locally agreed surface water information dataset is from the modelling work undertaken as part of the Drain London project for the production of the PFRA and Surface Water Management Plan[102]. The Environment Agency Flood Map for Surface Water (FMfSW) has also been reviewed (see Map WR-01-004, Volume 5, Water Resources and Flood Risk Assessment Map Book). The FMfSW has been used as the basis for the assessment of the impact of the Proposed Scheme on the risk of surface water flooding.

13.3.21 The LBB PFRA reports that a number of properties were affected during a flood event in July 2007, although the specific locations of the properties affected are not available. The main cause of flooding was a combination of surface water runoff and inadequate sewer capacity. A news report[103] indicates that a bridge on the A4000 Victoria Road flooded during intense rainfall in August 2004.

13.3.22 According to surface water flood risk datasets, including the FMfSW and PFRA modelling, there are areas within this study area that have a high risk of surface water flooding in a 1 in 200 annual probability (0.5%) rainfall event. Surface water flood risk has been considered only in the vicinity of where there will be above-ground works or structures.

13.3.23 The areas currently at risk of surface water flooding close to above-ground infrastructure required for the Proposed Scheme are residential streets and existing railway tracks in Kilburn, isolated topographic depressions at Old Oak Common, a

[101] The Detailed River Network (DRN) is a national Environment Agency dataset that shows the centre line of surface water features in England and Wales. It was produced by taking the water features theme of the OS MasterMap topographic layer, creating a connected network, and adding local information.
[102] Hyder/AECOM (2011), *London Borough of Brent Surface Water Management Plan*.
[103] Evans, T. (2004), *Historical flooding in Victoria Road, Acton*; http://news.bbc.co.uk/media/images/39919000/jpg/_39919124_flood300b.jpg; Accessed: March 2013.

bridge on the A4000 Victoria Road, and areas of predicted ponding in the industrial areas at North Acton.

Sewer flooding

13.3.24 The agreed datasets for sewer flooding are Thames Water records in the PFRA reports. Thames Water's historical sewer flooding records show that there have been a number of sewer flooding incidents within this study area. To the south of the route, close to the proposed Salusbury Road vent shaft, there is shown to be an area of historical sewer flooding. Within two adjacent postcode areas, 70 to 150 sewer flooding incidents were recorded up to June 2010. To the south-west of the proposed Old Oak Common station and Victoria Road crossover box there are two further adjacent postcode areas where 21 to 50 and 51 to 100 sewer flooding incidents have been recorded, respectively.

13.3.25 Surface water flood mapping, as previously described, is considered to represent the flow paths in the event of an inundation of the surface water or combined sewer network and is therefore relevant to the risk of sewer flooding.

Artificial water bodies

13.3.26 Flooding from artificial water bodies, such as canals and reservoirs, may occur as a result of failure of a retaining structure that impounds water. The agreed dataset for flooding due to reservoir failure is the Environment Agency Reservoir Inundation Map, as shown on Map WR-01-004 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

13.3.27 Although unlikely, a potential risk of flooding associated with a breach of the Grand Union Canal (Paddington Arm) has been identified close to the proposed Old Oak Common station. The canal is retained on its southern side in this location. Managed water levels are approximately 1.8m to 4.5m above nearby ground levels. The Canal & River Trust is responsible for the maintenance of the canal network. The Canal & River Trust has confirmed that there are 43km of unrestrained water (i.e. no locks) on this reach. Consequently, there is not expected to be a significant variation in the water level within the canal and there is no risk of the canal overtopping. The Canal & River Trust survey in 2003[104] concluded that the condition of the retaining structure was Grade C or 'fair' (where Grade A is 'new/excellent' and Grade E is 'bad/failing'), and that the consequence of failure score for the retaining wall was five (i.e. major damage and risk to life).

13.3.28 The route will not cross any areas that are shown to have a residual risk of flooding from failure of reservoirs.

[104] British Waterways (2003), *Investigation ESPI Project Principal Inspection Report Paddington Arm Grand Union Canal GP-01600R to GP-01715R Embankment Right side Project reference IE020011).*

Groundwater flooding

13.3.29 The agreed dataset for groundwater flooding is the PFRA reports.

13.3.30 There are no historical incidents of groundwater flooding within the study area. The PFRAs do not show any areas to have an increased potential for elevated groundwater.

Future baseline

13.3.31 Volume 5: Appendix CT-004-000 identifies developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The potential cumulative effects arising from committed developments in relation to water resources and flood risk have been considered as part of this assessment of the construction and operation of the Proposed Scheme.

13.3.32 All developments are required to comply with the National Planning Policy Framework (NPPF)[105], development plans and other legislation and guidance. As such committed developments should have a neutral effect on the water resources and flood risk baseline.

13.3.33 The Crossrail depot will be constructed to the north of the Old Oak Common station main compound prior to 2018. The surface water drainage for the depot will not worsen the existing pattern of runoff as the design and construction of the drainage will have to be in compliance with NPPF and London Plan guidance. Therefore, it is assumed that there are no committed developments that are likely to cause changes to the water baseline prior to construction in this study area.

13.3.34 WFD future status objectives are set out in Table 21 and Table 22. This potential change in baseline is not considered to result in the reported effects from the Proposed Scheme changing in significance.

13.3.35 The Environment Agency has set the 2015 WFD objective for the Grand Union Canal (Uxbridge to Hanwell Locks, Slough Arm, and Paddington Arm) as 'Good potential'. Objectives are not set for the unclassified water bodies listed in Table 21.

Climate change

13.3.36 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the Proposed Scheme on surface water and groundwater resources have been assessed. There may be changes in the flow and water quality characteristics of surface water and groundwater bodies as a result of changes in climate. However, except for flood flows described below, these are not

[105] Department for Communities and Local Government (2012), *National Planning Policy Framework Technical Guidance.*

considered to result in significant changes to the reported effects from the Proposed Scheme.

13.3.37 Current projections indicate that there will be more frequent, higher intensity rainfall events in the future. The probability and severity of surface water flooding could therefore increase as surface water drainage systems fail to cope with more frequent, higher intensity storms. Peak river flows during flood events are expected to increase, potentially causing greater depths and extents of flooding.

13.3.38 When considering the influence that climate change may have on the future baseline, against which the impacts from the Proposed Scheme on flood risk have been evaluated, the assessment has used the recommended precautionary sensitivity ranges of key parameters, as given in Table 5 in the technical guidance to the NPPF. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.

13.3.39 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Sections 7 and 8 of Volume 1 and Table 13 of Volume 5: Appendix CT-009-000.

13.4 Effects arising during construction

Avoidance and mitigation measures

13.4.1 The general approach to mitigation is set out in Volume 1, Section 9.

13.4.2 The route of the Proposed Scheme in the study area will be entirely within the London Clay Formation. This avoids any construction within aquifers and minimises the impacts on groundwater and surface water bodies and flood risk.

13.4.3 Mitigation measures to reduce potential adverse impacts includes sustainable drainage systems, where reasonably practicable, to reduce the rate and volume of run-off from the railway and associated infrastructure to prevent an increase in flood risk. Surface water runoff from permanent infrastructure at the proposed Old Oak Common station and the Salusbury Road vent shaft will be attenuated to existing rates, before being discharged to the public sewer network. Tunnel drainage at the Salusbury Road vent shaft will be a minimal volume and will be pumped out for disposal to sewer at a controlled rate.

13.4.4 Consents to discharge will be obtained prior to construction from Thames Water Utilities to ensure that there is sufficient capacity in the receiving infrastructure. This will avoid an increase in the risk of surface water or sewer flooding.

13.4.5 The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. It will provide effective management and control of the impacts during the construction period.

13.4.6 Measures included in the draft CoCP will be implemented to avoid temporary effects on water quality. This includes measures to prevent the uncontrolled discharge of sediment and pollutants into the Grand Union Canal from the construction compounds in the vicinity of Old Oak Common station. This will include the provision of silt-traps and adherence to the Environment Agency's Prevention of Pollution Guidelines[106].

13.4.7 Agreement with the Environment Agency to undertake, if required, pre-construction monitoring of surface water quality to establish baseline conditions for the Grand Union Canal and other unclassified water features. Monitoring may also be required to confirm the effectiveness of agreed construction temporary and construction permanent mitigation measures.

13.4.8 Activities within construction compounds, including those required for utility diversions, will be carried out in accordance with the draft CoCP.

13.4.9 Construction sites located within flood risk areas, such as at the Victoria Road crossover box and Old Oak Common station, will have site specific flood risk management plans prepared prior to construction, as stated in Section 16 of the draft CoCP. These will ensure construction activities will not increase the risk of flooding from surface water to local receptors.

13.4.10 Temporary crossings will be constructed over the Grand Union Canal to access the Willesden Euroterminal main compound and Atlas Road satellite compound. Construction elements will be located close to the Grand Union Canal such as storage facilities, temporary earthworks and accommodation facilities. It is considered that any potential adverse impacts (e.g. sediment or contaminant release) on the Grand Union Canal will be minimised through implementation of measures set out in the draft CoCP.

13.4.11 Where the tunnels will pass beneath the Grand Union Canal, ground settlement could occur at the surface as a result of the tunnelling works. In addition, the canal retaining wall is shown to be located within the settlement contour of the proposed Old Oak Common station excavations. The possibility of movement, and potential failure, of the canal retaining walls and towpath has therefore been considered.

13.4.12 An impact assessment of the retaining wall at Old Oak Common concludes that the predicted risk of damage to the masonry Old Oak Common retaining walls due to excavation of the tunnels is negligible.

13.4.13 Mitigation during excavation of the tunnels and the station box will incorporate targeted monitoring of the Grand Union Canal (Paddington Arm) retaining wall to

[106] Scottish Environment Protection Agency, Environment Agency (October 2007), *Pollution Prevention Guidelines - Works and maintenance in or near water: PPG5*.

assess any ground movement during construction activities that might have an effect on the structural integrity of the canal wall and trigger a potential breach with any resulting remedial works undertaken. This will ensure that the temporary effects of the tunnel and station box excavation works on flood risk are not significant.

Assessment of impacts and effects

13.4.14 This section describes the significant effects following the implementation of avoidance and mitigation measures.

13.4.15 Further details of the potential impacts that will not have significant effects are provided in the Water Resources Assessment report in Volume 5: Appendix WR-002-004 and Flood Risk Assessment in Volume 5: Appendix WR-003-004.

13.4.16 The assessment of the impact on the WFD status of surface waters is detailed within the WFD Compliance Assessment, contained within the route-wide Water Resources appendix (Volume 5: Appendix WR-001-000).

13.4.17 It is not considered that projected climate change effects, combined with the effects from the construction of the Proposed Scheme, will alter the significance of any of the reported effects on surface water and groundwater resources (see Volume 3: Route-wide Effects Assessment for further information).

Temporary effects

Surface water

13.4.18 The assessment shows that there will be no significant temporary adverse effects on surface water features during the construction period.

Groundwater

13.4.19 The assessment shows that there will be no significant temporary adverse effects on groundwater during the construction period.

Flood Risk

13.4.20 There will be no temporary effects that will increase the risk of flooding from rivers, surface water, sewers and groundwater as a result of the Proposed Scheme.

Cumulative effects

13.4.21 There are no committed developments that have been identified which will result in significant cumulative effects.

Permanent effects

Surface water

13.4.22 No significant adverse effects to surface water resources have been identified by the assessment.

Groundwater

13.4.23 The route will run within unproductive strata and will have no impact on groundwater. The assessment shows that there will be no permanent significant adverse effects on groundwater as a result of the construction of the Proposed Scheme in the study area.

Flood Risk

13.4.24 The assessment shows that there will be no permanent adverse effects on the risk of flooding from all sources.

Cumulative effects

13.4.25 There are no committed developments that have been identified which will result in significant cumulative effects.

Other mitigation measures

13.4.26 During the construction of the proposed scheme, the integrity of the retaining wall will be monitored prior to, and during construction, to a regime to be developed in consultation with the Canal & River Trust. Should any movement of the canal wall be detected, additional contingency measures will be identified in agreement with the Environment Agency and in consultation with the Canal & River Trust, Network Rail and Crossrail to reduce the risk of breach of the canal wall. As a result, the failure of the canal wall during construction is considered to be unlikely and while the consequences would be considered a significant effect, the risk of flooding therefore is negligible.

13.4.27 No other mitigation measures are envisaged within this study area.

Summary of likely significant residual effects

13.4.28 No significant adverse residual surface water, groundwater effects during construction have been identified within the assessment.

13.4.29 The risk of the canal wall being breached during the construction phase, and consequent flooding, is considered to be negligible. However, if this were to occur, this will be a significant temporary effect.

13.5 Effects arising from operation

Avoidance and mitigation measures

13.5.1 Generic examples of design measures that will mitigate impacts so that there will be no significant adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies during operation and management of the Proposed Scheme are described in Volume 1, Section 9.

13.5.2 Generic examples of management measures during operation and management of the Proposed Scheme that will mitigate impacts so that there are no significant

adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies are described in Volume 1, Section 9, and in the draft operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.

13.5.3 Operation and management of the Proposed Scheme is not likely to have a significant adverse effect on flood risk anywhere in the catchments through which it will pass. Generic examples of management measures that may mitigate flood risk are described in Volume 1, Section 9.

13.5.4 Surface water runoff and drainage systems from permanent infrastructure will be designed to attenuate runoff before being discharged to the Thames Water sewer network to address flood risk. This attenuation will also serve to reduce the risk of contaminated runoff entering Thames Water sewers as a result the operation of the Proposed Scheme.

Assessment of impacts and effects

13.5.5 There are considered to be no significant adverse effects to surface water, groundwater or flood risk arising from the operation of the Proposed Scheme.

Other mitigation measures

13.5.6 There are considered to be no further measures required to mitigate adverse effects on water resources or flood risk.

Summary of likely significant residual effects

13.5.7 No significant adverse residual surface water, groundwater or flood risk effects during operation have been identified within the assessment.

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