

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA26 | Washwood Heath to Curzon Street

November 2013

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Department
for Transport

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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: 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 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

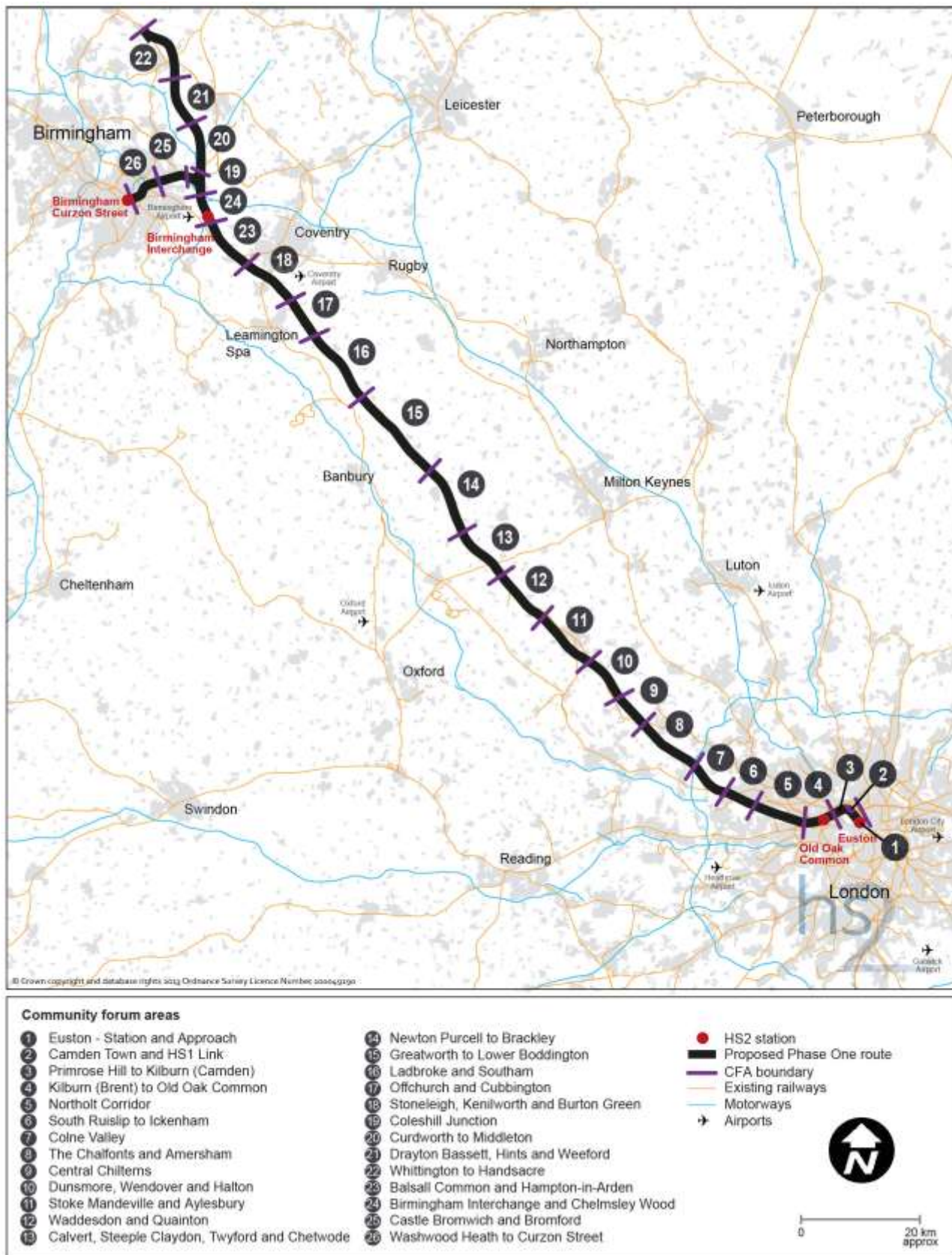
1.1 Introduction to HS2

- 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 2033/2024.
- 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 Two operational frequency has been used. For further detail about operation of the scheme in the Washwood Heath to Curzon Street (CFA26) area, 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 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 CFA26 (Washwood Heath to Curzon Street). The report describes the 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 CFA26.

Figure 1: HS2 Phase One route and community forum areas



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.
- Sections 3-13 – an 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 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. Volume 1 and Section 6A of the SMR Addendum also include additional information about climate change adaptation and resilience.

1.3.5 The maps relevant to Washwood Heath to Curzon Street are provided in a separate corresponding document entitled Volume 2: CFA26 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 Volume 2: Map Series CT-05 (construction) and CT-06 (operation). There is some flexibility during detailed design to alter the horizontal and vertical alignments and other details within

the limits of deviation shown on the plans and sections submitted to Parliament and as set out in the Bill and this flexibility is included within the scope of the environmental assessment. Further explanation is provided in Volume 1, Section 1.4.

- 1.3.7 In addition to the environmental topics covered in Sections 3-13 of this report, electromagnetic interference is addressed in Volume 1 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 Overview of the area

2.1.1 The Washwood Heath to Curzon Street area covers a 5.7km section of the Proposed Scheme in Birmingham, to the east of the city centre. It extends from the A4040 Bromford Lane in the east to Moor Street Queensway, on the eastern edge of Birmingham city centre, in the west. The area includes the Birmingham City Council (BCC) wards of Hodge Hill, Washwood Heath, Nechells and Ladywood.

2.1.2 This area is the most westerly CFA along the route of the Proposed Scheme. Castle Bromwich and Bromford (CFA25) lies to the east, as shown in Figure 2.

The case for Washwood Heath depot and Curzon Street station

Policy case

2.1.3 The case for HS2 is well established within national and regional policy.

2.1.4 The Department for Transport's 'High Speed Rail: Investing in Britain's Future'¹ confirmed the choice of Curzon Street as the site for a Birmingham terminus for HS2, best serving passenger requirements including onwards travel, along with the associated regeneration benefits. It also identifies the need for separate infrastructure and rolling stock maintenance depots at key points along the route, in order for the railway to operate effectively. The Washwood Heath depot is identified as supporting both Phases One and Two.

2.1.5 Key local policies are set out within the Birmingham Big City Plan (2010/11), Birmingham Unitary Development Plan (BUDP) 2005², the Birmingham Development Plan Options Consultation 2012³ and the West Midlands Local Transport Plan 2011⁴. The BUDP seeks to integrate transport with development across the Birmingham area and aims to enhance the wider road, rail and air links to the city taking advantage of the development of Birmingham Airport and improvements to the national motorway network. The Birmingham Development Plan Options Consultation identifies the proposed HS2 route as a key element of the city's transport infrastructure, helping to build upon the success of other improvements to transport infrastructure including improvements to Birmingham New Street station.

2.1.6 Emerging policies are not generally considered within this report, unless a document has been submitted to the Secretary of State for approval. The forthcoming Birmingham Development Plan, which will replace the BUDP, is currently under consultation, it will be submitted to Secretary of State for formal examination during 2014.

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

² Birmingham City Council, (2005), *Birmingham Unitary Development Plan*.

³ Birmingham City Council, (2012), *Birmingham Development Plan Options Consultation*.

⁴ Centro, (2011), *West Midlands Local Transport Plan*.

Washwood Heath depot

- 2.1.7 The area forms part of the city's core employment area as identified within the emerging Birmingham Development Plan Options Consultation 2012. The development of the Washwood Heath depot at this location will result in the loss of employment land.
- 2.1.8 As Washwood Heath depot is located at the centre of the national high speed rail network in the West Midlands, it will operate as the hub for high speed rail maintenance and operation, supporting both Phase One and Phase Two. In recognition of this BCC is currently preparing a development framework for the Washwood Heath depot site to ensure that following the construction of the Washwood Heath depot, economic growth and employment opportunities are maximised in the local area.

Curzon Street station

- 2.1.9 Birmingham's Big City Plan sets out the 20 year vision for transformational change within the city centre, and recognises that the Curzon Street station at Eastside will provide a significant catalyst for regeneration. The Eastside area is a key area of regeneration and growth within Birmingham's central core.
- 2.1.10 The Draft Eastside Masterplan 2011⁵ recognises the important role the Curzon Street station will play in 'enabling' regeneration, stating that it will transform Eastside into a key arrival destination, unlocking development opportunities and linking the quarter into the city centre's retail and office locations. Furthermore, the masterplan identifies that Curzon Square adjacent to the proposed Curzon Street station has the potential to become a cultural village, building a critical mass of artistic and creative activities.

Transport planning case

- 2.1.11 The West Midlands Local Transport Plan sets out a way forward to deliver the transport needs of the West Midlands Metropolitan Area through short, medium and long-term transport solutions. The West Midlands Local Transport Plan is supportive of HS2 and seeks to actively promote HS2 with the aim of providing the metropolitan area with high capacity, fast and reliable connectivity across the UK. This plan sees this connectivity as providing huge economic benefits to the region by allowing people to live and work in a greater range of places across the high speed rail network within the journey to work area, increasing their access to employment opportunities. HS2 therefore has an important role in delivering local transport strategy objectives towards supporting economic growth, reducing carbon emissions and reducing road congestion.
- 2.1.12 Centro's draft prospectus 'Towards a World Class Integrated Transport Network'⁶ sets out the Integrated Transport Authority's vision for public transport infrastructure in the region. The prospectus states: "It is essential that the West Midlands is connected to the European High Speed Rail Network. An international link to Birmingham Interchange and Birmingham city centre HS2 stations will improve economic

⁵ Birmingham City Council, (2011), *Eastside Masterplan Curzon District*.

⁶ Centro, (2012), *Towards a World Class Integrated Transport Network Public Consultation Draft December 2012 – February 2013*.

performance by increasing European connectivity and providing additional national rail capacity”.

- 2.1.13 Transport demand forecasts have demonstrated that the majority of the passengers travelling to and from Birmingham on HS2 would wish to travel to and from the central Birmingham terminus at Curzon Street station. This demand (66,000 trips per day) is split between 50% of trips wanting to access origins or destinations within Birmingham (by car, bus, local rail services, walking or cycling) and 50% of trips interchanging to other strategic rail services to access locations outside of the Birmingham urban area.
- 2.1.14 Trips forecast to use Curzon Street station and interchange to other strategic rail services will access these services at either of the existing central Birmingham stations including New Street, Moor Street or Snow Hill. These trips will interchange across Birmingham city centre between Curzon Street and the other city centre stations. HS2 Ltd will continue to work with Centro to discuss their aspirations for the Midland Metro.

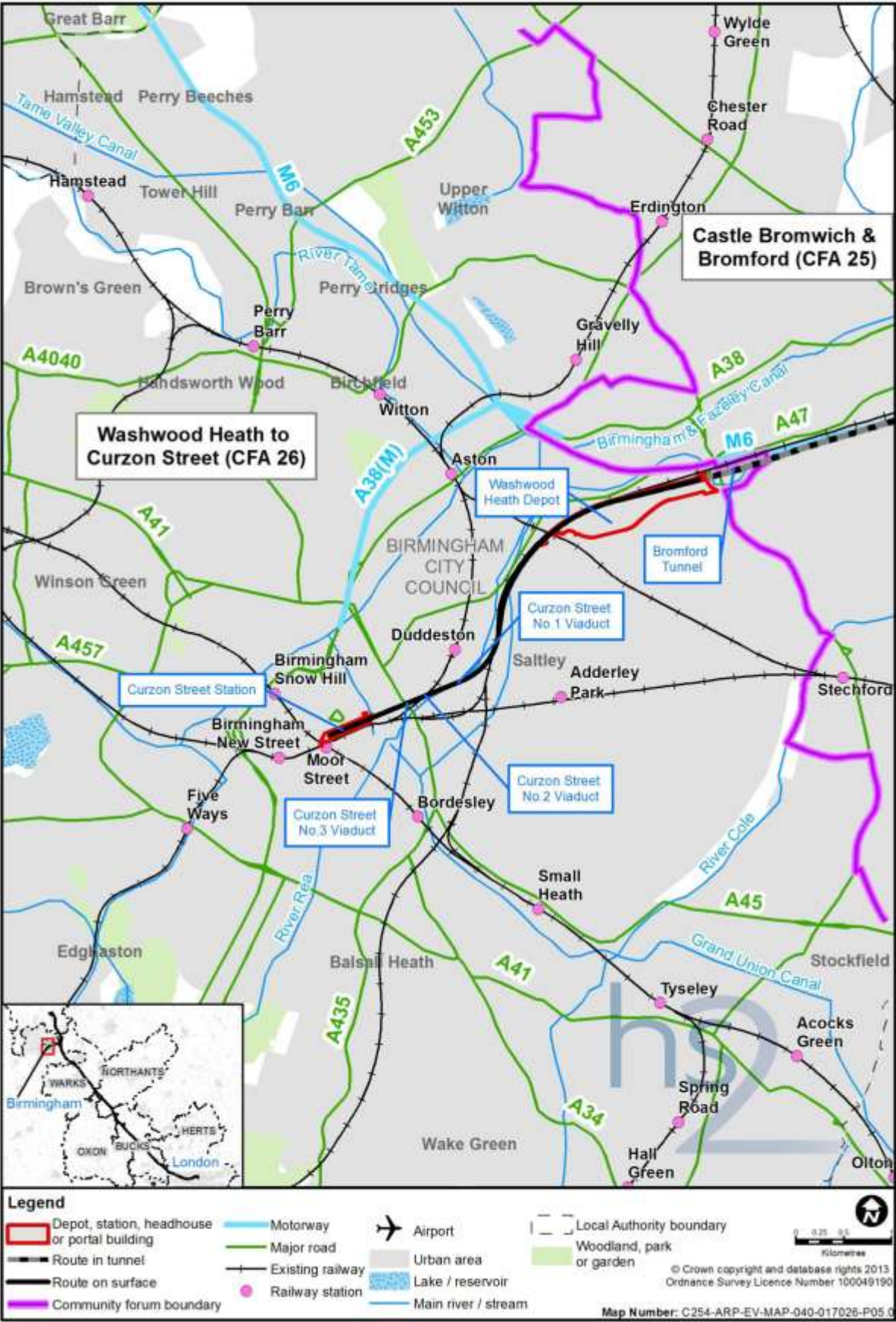
Settlement, land use and topography

- 2.1.15 The area is entirely urban, with land use comprising light industrial and commercial or infrastructure through Washwood Heath, Nechells and Saltley. These areas make use of the lower lying land close to the rivers Tame and Rea and also the historical infrastructure corridor that follows the valley. Bromford (in CFA25), Washwood Heath and Saltley are the nearest main residential areas, with Gravelly Hill (to the north) and Ward End (to the south) are also close by. Pockets of residential development occur in Nechells and around Curzon Street station.
- 2.1.16 The area has its high point at the western end, where the city centre is, approximately 120m above Ordnance Datum (AOD). The ground falls away east along the valleys of the River Rea and then the River Tame to approximately 85m AOD at Bromford. The river valley is the dominant topographic feature that defines the land use and views in this area. It is also the basis of the local floodplain and locally important wildlife corridors.

Key transport infrastructure

- 2.1.17 The key transport infrastructure in the Washwood Heath to Curzon Street area are the railways, roads and canals that lead to and from Birmingham city centre. Within this area, the route will run parallel to the Birmingham and Derby line, the M6 and the A47 Heartlands Parkway for most of the route. The Grand Union Canal and the Digbeth Branch of the Birmingham and Fazeley Canal (hereafter referred to as the Digbeth Branch Canal) are also present in this corridor. Consequently, there are a number of locally important public highway crossing points over the railway and canal corridor including the A4040 Bromford Lane, Aston Church Road, the B4114 Saltley Viaduct (High Street), Duddeston Mill Road and the A4540 Lawley Middleway.

Figure 2: Area Context Map



Socio-economic profile

- 2.1.18 To provide a socio-economic context for the area, data is presented for the demographic character areas (DCA) of Washwood Heath and Curzon Street⁷. In total, the population of the Washwood Heath and Curzon Street area is approximately 20,700; of which Washwood Heath DCA is approximately 9,300 and Curzon Street DCA is approximately 11,400, which highlights the urban nature of the area. In 2011, the unemployment rate for Washwood Heath DCA was 13% and 8% in Curzon Street DCA⁸ compared to West Midlands (9%) and England (7%).

Notable community facilities

- 2.1.19 No health facilities are directly affected by the Proposed Scheme. Within the immediate surrounding area are the following health facilities: The Dyslexia Association of Birmingham; counselling services at Carrs Lane Church; the Halcyon Medical and Walk-In Centre; and the Sensory Support Service.

Recreation, leisure and open space

- 2.1.20 Although Birmingham generally has a relatively large amount of public open space, the Nechells and Hodge Hill wards have a deficiency. Four open space areas have been identified within close proximity of the Proposed Scheme, including the Grand Union Canal, the Digbeth Branch Canal, Eastside City Park, and Park Street Gardens.
- 2.1.21 There is only one definitive public right of way (PRoW) in the area of the Proposed Scheme. The PRoW is not currently accessible, and connects Common Lane to Bromford Island, crossing the former Leyland DAF Vans (LDV) factory site in Washwood Heath. There are other footpaths within the wider study area that have been referred to in the assessment. The Grand Union Canal and Digbeth Branch Canal towpaths are other recreational routes close to the Proposed Scheme along with numerous public highways in the area which provide pedestrian access.

Planning context

Planning Framework

- 2.1.22 Given that HS2 is being developed on a national basis to meet a national need it is not included or referred to in many local plans, aside from those referred to in the previous section. Nevertheless, in seeking to consider the Proposed Scheme in the local context, relevant local plan documents and policies have been considered in relation to environmental topics.

⁷A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).

⁸All data comes from the 2011 Population Census: Office of National Statistics, (2011) *Census 2011*.

- 2.1.23 The following local policies have been considered and referred to where appropriate to the assessment. Where a policy document is not referred to within a particular technical section, it is due to the absence of policies of relevance to that topic:
- BUDP is the current adopted development plan for the BCC area; and
 - Birmingham Development Plan Options Consultation (2012) will replace the BUDP once adopted.
- 2.1.24 There are a number of key planning designations in the area, which include: conservation areas, listed buildings, scheduled monuments, important archaeological sites, and historic parks and gardens. These are shown on Volume 2: Maps CT-10-068b to CT-10-070, and Volume 5: CH-02-156b to CH-02-158-R1.

Committed development

- 2.1.25 Developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme, are shown in Volume 2: Maps CT-13-068b to CT-13-070 and listed in Volume 5: Appendix CT-004-000.
- 2.1.26 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. The following developments are relevant to several topics assessments in this area:
- planning reference 2012/04578/PA – mixed use development 'student hub' including formal teaching areas as part of the Birmingham City University Campus at land bounded by Gopsal Street, Cardigan Street, Curzon Street and Digbeth Branch Canal within the Eastside area of the city;
 - planning reference 2007/01816/PA – a mixed use development including residential with 353 flats at Bordesley Street, Typhoo Wharf in Digbeth;
 - planning reference 2007/01816/PA – a mixed use development comprising four buildings at Masshouse (Plot 7) on land bounded by Dale End, Chapel Street, Moor Street Queensway and Priory Queensway;
 - planning reference 2013/01181/PA – the conversion of a retail unit to five dwellings as Masshouse Plaza;
 - planning reference 2008/02942/PA – the redevelopment of Eastside Locks comprising mixed use development including 475 residential units;
 - planning reference 2011/00453/PA – erection of a five storey building for education use with associated access, parking and landscaping at Cardigan Street on land adjoining Millennium Point, Eastside;
 - planning reference 2009/00295/PA and 2012/02104/PA – Beorma Quarter development including refurbishment of existing buildings and construction of new buildings for a mixed commercial and leisure development; and
 - planning reference 2012/06883/PA – Permission for change of use and

alterations to the former Central Fire Station to create a mixed use development including student residential accommodation and commercial premises.

- 2.1.27 Where a committed development lies wholly or partly within the land required for the Proposed Scheme, it is assumed that the development will not be commenced or completed in its proposed form. Such developments are referred to in the relevant topic section and noted in Volume 5: Appendix CT-004-000.
- 2.1.28 No developments have been identified which are likely to have cumulative effects, when considered together with the Proposed Scheme.
- 2.1.29 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. These are not included in the assessment⁹. The progress of these proposals is being monitored by HS2 Ltd.

2.2 Description of the Proposed Scheme

- 2.2.1 The following section describes the main features of the Proposed Scheme in the Washwood Heath to Curzon Street 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.
- 2.2.2 The Proposed Scheme will require some land on a permanent basis, key features of which are illustrated in the Volume 2: Maps CT-06-138b to CT-06-142.
- 2.2.3 In general, features are described from east to west along the route (and south to north for features that cross HS2).
- 2.2.4 Since the draft ES was published the following changes have been introduced to permanent features of the Proposed Scheme:
- increasing the overall Bromford tunnel depth (from the top of the tunnel being 15m below ground level in the draft ES, to now 30m, as described below);
 - relocation of the auto-transformer station from Saltley Business Park to Curzon Street;
 - retention of the Midland Tavern building on Inkerman Street;
 - provision of access to the Staffordshire and West Midlands Probation Trust, Saltley Business Park;
 - refinements to the layout of Washwood Heath depot and Curzon Street station; and
 - increase in height of Curzon Street No.1 viaduct by 1.5m.

⁹ For traffic and transport and topics that make use of traffic flow forecasts, future baseline and with the Proposed Scheme flows take into account all planned development, including proposed development, to establish a robust baseline.

Overview

- 2.2.5 The route will enter the Washwood Heath to Curzon Street area in tunnel from the Castle Bromwich and Bromford area (CFA25) to the east, heading in a westerly direction. The route will emerge via a tunnel portal, west of the River Tame, within Washwood Heath, which will also be the location for the network control centre and rolling stock maintenance depot. From Washwood Heath, the route will continue westwards, running parallel to the Birmingham and Derby line, passing under the bridges carrying the Stechford and Aston line and Aston Church Road. The route will pass over the Grand Union Canal and, under the B4114 Saltley Viaduct, before rising on viaduct over Network Park industrial estate, to cross over Duddeston Mill Road, the Birmingham and Derby line and heading into the city centre, passing through Freightliner Terminal Depot and over the River Rea. The route then passes over the Birmingham and Bushbury line at Vauxhall and the A4540 Lawley Middleway still on viaduct before it arrives at a new terminus station at Curzon Street. Curzon Street station will be a seven platform station extending from the Digbeth Branch Canal to Moor Street Queensway with a pedestrian link to Moor Street station at its western end.

Bromford tunnel and Bromford tunnel west portal

- 2.2.6 The route will be in the proposed Bromford tunnel as it enters, from the adjacent Castle Bromwich and Bromford area (CFA25), into the Washwood Heath to Curzon Street area, approximately 500m east of the A4040 Bromford Lane. As the Bromford tunnel approaches Washwood Heath, it will pass in succession under the River Tame, the A4040 Bromford Lane and a further upstream section of the River Tame. The route will leave the tunnel via the western tunnel portal, where the train tracks gradually rise from below ground level to ground level as it heads towards the replacement Washwood Heath rail overbridge, which carries the Stechford and Aston line over the Birmingham and Derby line.
- 2.2.7 The key design features of this section (broadly east to west) include:
- the Bromford tunnel will be approximately 2.9km in length (not including the tunnel portal cuttings), approximately 2.2km of which will be in the adjacent Castle Bromwich and Bromford area (CFA25) to the east and the remainder (0.7km) in the Washwood Heath to Curzon Street area. Each bore will have an external diameter of approximately 8.25m as excavated and a finished internal diameter of approximately 7.55m once lined. There will be cross-passages connecting the two bores, for access, approximately every 380m.
 - the top of the tunnel bore will be up to 30m below existing ground level, with the track level up to 37m below ground level;
 - a concrete slab in the bed of the River Tame (Volume 2: Map CT-06-139b, 15). This will strengthen the river bed to enable the tunnel to be constructed beneath. Temporary works within the river channel will be required to allow the slab to be built;
 - a realigned access to the Network Rail access point and access to the Bromford auto-transformer station and the depot switching station;

- the Bromford auto-transformer station (Volume 2: Map CT-06-139b, I5);
- the Bromford tunnel west portal (Volume 2: Map CT-06-139b, I5), which will be located approximately 150m west of the A4040 Bromford Lane. A tunnel portal headhouse will be located at the tunnel's entrance, along with a depot switch station, positioned adjacently north of the route. An emergency rescue area will also be located at the western portal to accommodate any emergency evacuation of passengers and also vehicular access for emergency services to these points. The headhouses¹⁰ at the Bromford tunnel's west portal and east portal (the latter being located in the adjacent Castle Bromwich and Bromford area (CFA25)) will house the control equipment for the tunnel and ventilation fans; and
- a retained cutting (known as Washwood Heath retained cut), approximately 22m in depth at its deepest. As it passes the Washwood Heath depot, the route rises towards the Stechford and Aston line (which the route will pass under). The route will rise above ground level 400m to the east of the Stechford and Aston line.

2.2.8 Construction and installation of the above elements will be managed from the Bromford tunnel west portal (east) main compound, Bromford tunnel west portal (central) satellite compound, Bromford tunnel west portal (west) satellite compound and Bromford tunnel west portal (railway installation) compound.

Washwood Heath depot

2.2.9 A proposed Washwood Heath depot (Volume 2: Map CT-06-139b) will be the Proposed Scheme's rolling stock maintenance depot and network control centre. This depot will serve as an operational and maintenance hub; with activities will include light and heavy maintenance, where train servicing (plus interior and exterior cleaning) will take place on the entire HS2 fleet. The operation of the Washwood Heath depot is described further in Section 2.4. The primary purpose of the network control centre will be to supervise and control activities on the railway in real time.

2.2.10 The depot site will be approximately 1.6km long and 400m wide. This will be at land west of A4040 Bromford Lane and the River Tame, north of Warren Road and Drews Lane, south of the Birmingham and Derby line, and east of the Stechford and Aston line (although the access/egress tracks from the west to the Washwood Heath depot will extend further west beyond the B4114 Saltley Viaduct). The site comprises the area historically developed as the Washwood Heath railway works and the Ward End vehicle works, both of which had several operators, but latterly Alstom for the railway works and LDV for the motor works. Much of the railway works is currently vacant, although the buildings remain. Much of the vehicle works has been cleared. The site's current occupiers comprise UK Mail (Birmingham depot for express parcels delivery) in the north-eastern quarter, a yard at the rear of Charles Wilson Engineers Ltd (also known as CW Plant Hire) south of Wolsley Drive, a parking area for DVLA also south of Wolsley Drive, Cemex UK (concrete and asphalt products) in the north-western quarter, and Hanson Heidelberg Cement Group (ready mixed concrete plant) also in

¹⁰ A headhouse is above ground structure which sits at the top of a ventilation shaft or tunnel portal, in this case, the portals for Bromford tunnel.

the north-western quarter. In this report, the term "Washwood Heath depot" refers to the proposed development for all of the area described above; "former Washwood Heath railway works and former Ward End vehicle works" refers to the historic uses for all of this area.

2.2.11 Key design features of this section include (described broadly from east to west):

- a gatehouse, approximately 27m long, 8.5m wide and 4m high, at the site's access on Wolseley Drive (Volume 2: Map CT-06-139b, I6). Wolseley Drive will be realigned and used as the road access to Washwood Heath depot. This will extend into an internal road network, generally on the southern side of the site, and leading to the main buildings at the western end of the site with associated car parking;
- operational buildings at the eastern end of the site (Volume 2: Map CT-06-139b, H5) which will include a depot switching station and three smaller buildings (the utility meter room, a pumping station and cleaner storage and plant room);
- two stabling yards where trains will be cleaned and stabled overnight. One at the eastern side and one in the centre of the site. The stabling yards comprise sidings where trains will be parked. Each stabling track will be up to 420m long and able to hold two 200m train sets;
- the realignment of the existing Network Rail Duddeston Down Through Track (Volume 2: Map CT-06-139b, E5) to allow the route to pass under the Washwood Heath rail overbridge;
- three balancing ponds¹¹ at the eastern end, along the southern side of the depot between Wolseley Drive and Common Lane (Volume 2: Map CT-06-139b, G6, F7 and E7). These take drainage outfalls from, respectively east to west: the tunnel pump station; depot drainage; and the route (in the vicinity of the Stechford and Aston line);
- the permanent diversion of Washwood Heath Brook into a new channel to a new outfall to the River Tame, approximately 150m downstream of where it currently outfalls (Volume 2: Map CT-06-139b, H6);
- a maintenance shed including workshops where all maintenance on the trains will take place (Volume 2: Map CT-06-139b, C7). Trains that require mechanical examinations and overhaul will be moved to this building, which will be approximately 250m long, 120m wide and 14m high;
- to the north of the maintenance shed a cleaner's store and plant room (Volume 2: Map CT-06-139b, B6). Also to the north of the maintenance shed a wheel lathe and plant room (Volume 2: Map CT-06-139b, C6) will be located next to the central stabling yard. This is where trains will have their wheels reprofiled to maintain safe high speed running capability;

¹¹ A balancing pond is part of a drainage system that is used for temporarily storing railway and highway drainage water.

- at the western end of the maintenance shed will be a block (Volume 2: Map CT-o6-139b, B7) containing offices, training centre, cleaners and train crew facilities and also the depot control room to manage train movements within the depot. This will be a two-storey block, approximately 130m long, 21m wide and 14m high;
- a landscape and local habitat planting strip along the southern side of the Washwood Heath depot, including native trees and shrubs and acid grassland. Two of the depot buildings will have an ecologically designed brown roof¹²;
- a network control centre building which will be located in the western part of the site (Volume 2: Map CT-o6-139b, B6). This building will be approximately 60m long, 38m wide and 10.5m high;
- a carriage washing machine plant, approximately 50m long, 14m wide and 5m high, (Volume 2: Map CT-o6-140, G6) located along the western access into the Washwood Heath depot (just south of Aston Church Road);
- adjacent to the two main tracks, two depot entrance and egress tracks from the west of the depot (to receive trains from and dispatch trains to Curzon Street station). These tracks are described in the Washwood Heath rail overbridge, Aston Church Road overbridge, Saltley canal underbridge and B4114 Saltley viaduct section below; and
- a diversion of a 900mm diameter foul sewer diversion around the proposed Washwood Heath depot maintenance shed.

2.2.12 Figure 3 provides a visualisation of the Washwood Heath depot¹³.

¹² A brown roof is one which may be partially or fully covered in vegetation in order to benefit ecology.

¹³ This visualisation only shows the Washwood Heath depot for context and is not intended to accurately show the likely neighbouring land uses.

Figure 3: Washwood Heath depot visualisation (looking east)



- 2.2.13 Construction of Washwood Heath depot will be managed from the Bromford tunnel west portal (west) satellite compound.

Washwood Heath rail overbridge, Aston Church Road overbridge, Saltley canal underbridge and B4114 Saltley viaduct

- 2.2.14 After passing Washwood Heath depot, the route will pass under the existing Stechford and Aston line and proceed in a southerly direction, remaining south and east of the existing railway. Part of the existing Stechford and Aston line bridge will be replaced by a new overbridge (known as Washwood Heath rail overbridge) where it will cross the route (Volume 2: Map CT-06-140, G6).
- 2.2.15 The route will then pass under a replacement Aston Church Road bridge and through the western edge of Saltley Business Park before passing over the Grand Union Canal on a new underbridge (known as Saltley canal underbridge) (Volume 2: Map CT-06-140, C6). The route will then pass under a replacement of the existing B4114 Saltley Viaduct (Volume 2: Map CT-06-140, C7). Immediately south of the new B4114 Saltley viaduct, the route will rise further, with an embankment (known as the Saltley retained fill) on the south side and a retaining wall on the north adjacent to the Birmingham and Derby line, through the western edge of the Network Park industrial estate towards Duddeston Mill Road.
- 2.2.16 Running parallel and to the south of the main line will be two reception tracks used to enter and exit Washwood Heath depot. Coming out of the depot, trains will pass through the carriage washing machine plant before rising to meet the main line at Saltley Canal underbridge, the turnouts diverging from the mainline north of Network Park industrial estate (Volume 2: Map CT-06-140, B7).

2.2.17 The key design features of this section will include:

- a replacement to part of the existing Stechford and Aston line bridge with a new bridge (known as Washwood Heath rail overbridge) over the route (Volume 2: Map CT-06-140, G6). There will also be a relocated Network Rail maintenance access to this bridge from the Aston Church Road;
- a new Aston Church Road overbridge over both the existing Birmingham and Derby line and the route (Volume 2: Map CT-06-140, G6);
- a new bridge (known as Saltley canal underbridge) (Volume 2: Map CT-06-140, C6) to carry the route over the Grand Union Canal;
- a new, longer viaduct to replace the existing B4114 Saltley Viaduct (Volume 2: Map CT-06-140, C7);
- a realignment of the River Rea Overflow Channel, to the east of the Grand Union Canal, for a total of approximately 670m, of which, approximately 380m will be open channel and the rest enclosed culvert (Volume 2: Map CT-06-140, G5 to D6);
- Saltley retained fill embankment (Volume 2: Map CT-06-140, F6);
- two balancing ponds, one approximately 50m north of B4114 Saltley viaduct, and one approximately 300m south (Volume 2: Map CT-06-140, C6 and B7);
- strips of native tree and shrub planting along the eastern embankments of the route (Volume 2: Map CT-06-140, B7);
- alterations to the existing railway sidings which will include new track installation and the renewal of points and crossings opposite the Washwood Heath depot; and
- the permanent utility diversions along Aston Church Road (including gas mains, high voltage electricity cables, water mains, combined and surface water sewers and telecommunication cables), B4114 Saltley Viaduct (high voltage electricity and telecommunication cables) and at Saltley Business Park and Network Park industrial estate (sewers).

2.2.18 Construction and railway installation of these design features will be managed from the Washwood Heath rail overbridge, Aston Church Road overbridge (west), Aston Church Road (east), B4114 Saltley viaduct (east) and B4114 Saltley viaduct (west) satellite compounds.

Duddeston Mill Road bridge, Duddeston Junction viaduct, Curzon Street No.1 viaduct, Curzon Street No.2 viaduct and Curzon Street No.3 viaduct

2.2.19 Immediately after passing under the B4114 Saltley Viaduct, the route rises, turns westwards and crosses the existing Birmingham and Derby line and Duddeston Mill Road on a new viaduct (known as Duddeston Junction viaduct), the height of which will be approximately 14m above ground level (height to rail level) as it crosses the road. As part of the Proposed Scheme, some of the Birmingham and Derby line tracks will be modified and a new Duddeston Mill Road underbridge will be constructed

alongside the existing underbridge to allow Duddeston Mill Road to pass under the realigned Network Rail lines.

- 2.2.20 After the route has crossed over the Birmingham and Derby line, it continues on viaduct (known as Curzon Street No.1 viaduct) and crosses over part of the Freightliner Terminal Depot before crossing the River Rea and an area of industrial land off Erskine Street (Volume 2: Map CT-06-141, G7).
- 2.2.21 The route continues on viaduct and then crosses the Birmingham and Bushbury line (also known as the Cross-City line) and Viaduct Street on Curzon Street No.2 viaduct (Volume 2: Map CT-0-141, C7). Continuing west, the route passes over St James' Place and the A4540 Lawley Middleway, which at this point will be on viaduct (known as Curzon Street No.3 viaduct) and approximately 16m above ground level (to rail level) (Volume 2: Map CT-06-141, B6).
- 2.2.22 While still on Curzon Street No.3 viaduct, from St James' Place, the twin-track railway will start to fan out to create the approach tracks into the proposed Curzon Street station crossing the Digbeth Branch Canal and lock, approximately 11m above ground level.
- 2.2.23 The key design features of this section are:
- a new Duddeston Mill Road bridge, to allow the diversion of the existing tracks to allow for the Duddeston Junction viaduct (Volume 2: Map CT-06-141, H6);
 - a new viaduct (known as Duddeston Junction viaduct) which will carry the route over the Birmingham and Derby line (Volume 2: Map CT-06-141, H6);
 - a new viaduct (known as Curzon Street No.1 viaduct) carrying the route over part of the existing Freightliner Terminal Depot, and the River Rea, towards Erskine Street (Volume 2: Map CT-06-141, G7);
 - a new viaduct (known as Curzon Street No.2 viaduct) carrying the route over the Birmingham and Bushbury line (Volume 2: Map CT-06-141, C7);
 - a new viaduct (known as Curzon Street No.3 viaduct) carrying the route over the Lawley Viaduct and up to the Curzon Street station (Volume 2: Map CT-06-141, B6);
 - three balancing ponds, one approximately 50m south of Duddeston Mill Road, near to the existing Network Rail Signalling Centre, one off Erskine Street, and one to the south of Curzon Street No.3 viaduct (Volume 2: Map CT-06-141, G6, E7 and B7);
 - Garrison Circus and Curzon Circle on the A4540 Lawley Middleway from roundabouts to traffic signal controlled junctions (Volume 2: Map CT-06-141, B9 and B6);
 - diversions of utilities including sewers at Duddeston Mill Road and Inkerman Street and water mains, sewers and telecommunication cables around Curzon Circle; and
 - the Curzon Street auto-transformer station, on the south side of Curzon Street, near the Curzon Circle (Volume 2: Map CT-06-141, B6).

- 2.2.24 Construction of these elements will be managed from Curzon Street No.1 viaduct satellite compound, Curzon Street No.2 viaduct satellite compound and Curzon Street No.3 viaduct satellite compound.

Curzon Street station

- 2.2.25 The proposed Curzon Street station will mark the western terminus of the Proposed Scheme. It will be over three main levels: a lower concourse level accessed from the east of the station, the platform level accessed from both the upper and lower concourses, and the upper concourse accessed from the west of the station. There will be seven platforms, including one with international capability. The lower eastern entrance will be accessed at ground level from New Canal Street and Curzon Street. The upper concourse western entrance of the station will front onto Moor Street Queensway at ground level, with a connection to Moor Street station.
- 2.2.26 The station will broadly occupy land from the Digbeth Branch Canal in the east to Moor Street Queensway at its western extent and between Curzon Street and the Rugby and Birmingham line. This area covers, from east to west:
- the existing streets of an unnamed access road off Curzon Street;
 - New Canal Street (between its crossing beneath the Rugby to Birmingham line and Curzon Street);
 - Banbury Street (from its junction with New Canal Street to its crossing beneath the Rugby to Birmingham line);
 - Andover Street (short section from its junction with Banbury Street and the crossing beneath the Rugby and Birmingham line);
 - Fazeley Street (north of the Rugby to Birmingham line);
 - Bartholomew Street (already closed off beneath the landscaped area, north of the Rugby to Birmingham line);
 - Park Street (between Masshouse Lane and Bordesley Street);
 - Seymour Street;
 - Freeman Street; and
 - Paternoster Row.
- 2.2.27 Volume 2: Maps CTo5 and CTo6 do not reflect the existing road layout in the area of the newly opened Eastside City Park. At the time of printing, up to date Ordnance Survey background mapping was not available. To ensure clarity on the Parliamentary plans the area of Eastside City Park has been masked out.
- 2.2.28 Figure 4: Visualisation of the proposed Curzon Street station (looking east) shows the proposed Curzon Street station and surrounding public realm¹⁴.

¹⁴ This visualisation only shows the Curzon Street station for context and is not intended to accurately show the likely neighbouring land uses.

Figure 4: Visualisation of the proposed Curzon Street station (looking east)



2.2.29 The lower eastern entrance will be beneath the platforms, close to the vehicular drop-off point and also the existing Grade I listed former Curzon Street Station building. There will be a third arrival and departure point for international travel only accessed from a remaining spur of Fazeley Street below the platforms. The upper station concourse at the western end will extend east for approximately 300m over the platforms. Lifts, stairs and escalators will carry passengers either down from the higher western concourse or up from the lower eastern entrance to the platforms. There will be service areas for international travellers within the complex.

2.2.30 Design features of Curzon Street station include:

- a roof and canopy structure that spans the length of the platforms allowing light into the station;
- seven platforms (each approximately 415m in length), arranged into three island platforms and a single face platform. Six of these platforms will be for domestic train services and the seventh will be capable of use by either domestic or international services;
- staff car parking, short stay car park, drop-off and pick-up areas and taxi rank;
- utility diversions (including water mains, electricity and telecommunications cables) from Freeman Street, Park Street, Fazeley Street to New Canal Street; and
- public realm.

2.2.31 Public realm improvements around Curzon Street station integrate the building into its surroundings. The design of the public realm encompasses; the area north of the station from the Digbeth Branch canal along Curzon Street and across Eastside to the

Moor Street Queensway frontage. The public realm for the Curzon Street station reflects the public spaces identified in the Eastside Masterplan: Curzon Square (equating to the area around the Grade I listed Curzon Street Station building), Curzon Promenade (the area to the north of the proposed Curzon Street station) and Station Square (the Moor Street Queensway frontage).

- 2.2.32 Curzon Square is defined as a public plaza near to the eastern entrance located on the north side of the elevated section of station and viaduct. Its northern boundary is defined by Curzon Street. The design of the public realm will integrate with the Eastside City Park extending along Curzon Street and its footpath network. The public plaza has been designed to consider safety, full compliance with relevant legislation and the setting of the Grade I listed former Curzon Street Station building using shared surfaces creating a clear arrival point continuing from kerb to station entrance. A gateway feature is proposed where Curzon Street meets the plaza. Curzon Street will be realigned as it turns south around the Woodman public house into New Canal Street, effectively extending the public plaza using shared surface design to ease movements of pedestrians between the station plaza and Curzon Promenade and in turn beneath the station and also the Rugby and Birmingham line viaduct. This important route eventually links with Fazeley Street and the Digbeth, Deritend and Bordesley High Streets Conservation Area. The design seeks to optimise permeability, minimise the amount of street furniture clutter and highway signage, and have appropriate robust, hard paved external space that allows movement of large numbers of people and locations for cycle facilities. Seating areas will be provided with integrated, low energy, feature and highway lighting to enliven and extend use of the space at night.
- 2.2.33 Curzon Promenade is defined in the Eastside Masterplan as the linear public space to the northern elevation of the elevated section of station and viaduct. Its northern boundary is defined by the Hotel La Tour, the Masshouse development and highway and the eastern extent of Eastside City Park. A key feature of this space is the considerable change in level rising from New Canal Street to Moor Street with channelled views east from Moor Street on an axis with the Grade I listed former Curzon Street Station building. This public realm area will provide access to retail units at the station and integrate with the eastern end of Eastside City Park, allowing for continuous cycle and pedestrian movements in all directions.
- 2.2.34 Station Square is defined as the public plaza to the western entrance at concourse level as the station fronts on to Moor Street Queensway. The plaza will serve as a forecourt between the station and Moor Street Queensway. This plaza will become a key destination for the city and serves as a transition route for pedestrians heading west to New Street Gateway via the Bullring Tunnel, routes towards the Learning Quarter to the north and a level connection to Moor Street station. Station Square will also be the station's front face to the city centre that will contribute to the identity of the city and the reinvention of Eastside.
- 2.2.35 There will be public realm space created around the Park Street taxi pick-up and Shaws Passage. This public realm will be located on the south side of the west entrance on Park Street across the Rugby and Birmingham line. This area will provide a pedestrian route known as the on the axis from Shaws Passage to Moor Street.

- 2.2.36 An area of public realm is proposed on the former Parcel Force site. It is an area of land located between the Ruby and Birmingham line, Digbeth Branch Canal, and Curzon Street No. 3 viaduct, above the 1838 railway bridge into the former Curzon Street Station.
- 2.2.37 There will be alterations to the existing street grid including changes to existing New Canal Street, Curzon Street, Fazeley Street and Andover Street (remaining spur). There will be a proposed 'Kiss and Ride'¹⁵ access road and service road from Banbury Street to New Canal Street alongside the Rugby and Birmingham line viaduct. The design of the public realm will also provide dedicated access to the Gun Barrel Proof House.
- 2.2.38 Construction of the proposed Curzon Street station and these other design features will be managed from Curzon Street station main compound and Curzon Street No.3 viaduct satellite compound.
- 2.2.39 Illustrative block plans of the three main levels of the proposed station show the indicative layout of Curzon Street station. Figure 5 shows the lower east entrance level. This level will contain passenger and staff facilities and will be accessible from New Canal Street.
- 2.2.40 Figure 6 shows the platform level at Curzon Street station. This level contains the train platforms and staff facilities. Figure 5 shows the lower east entrance level. This level will contain passenger and staff facilities and will be accessible from New Canal Street.
- 2.2.41 Figure 6 shows the platform level at Curzon Street station. This level contains the train platforms and staff facilities.
- 2.2.42 Figure 7 shows the upper concourse level, where it will be accessible through the main entrance at the stations western end from Moor Street Queensway.

¹⁵ A 'kiss and ride' is a drop off point for car users at stations, airports and interchanges.

Figure 5: Curzon Street station east entrance level layout

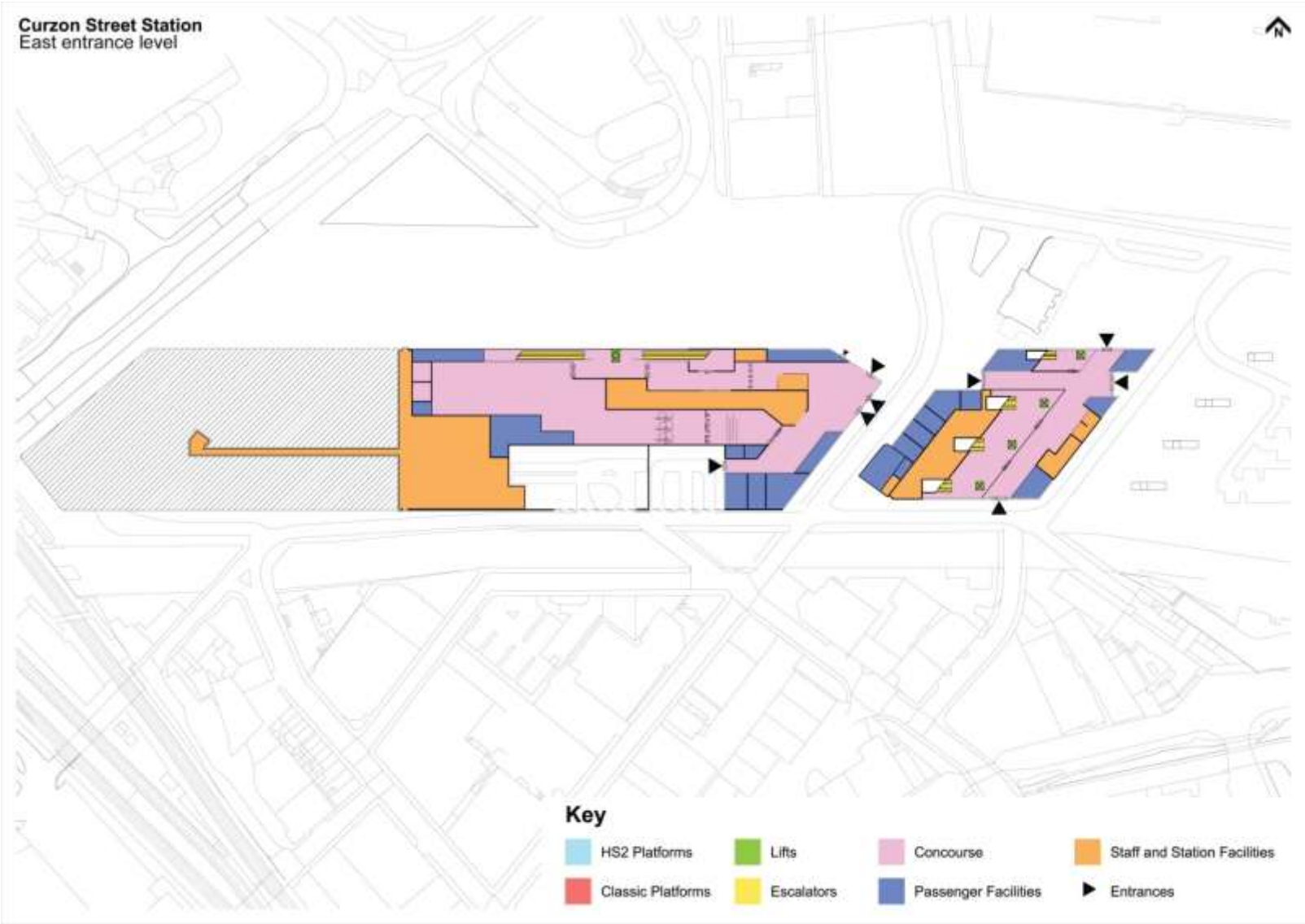
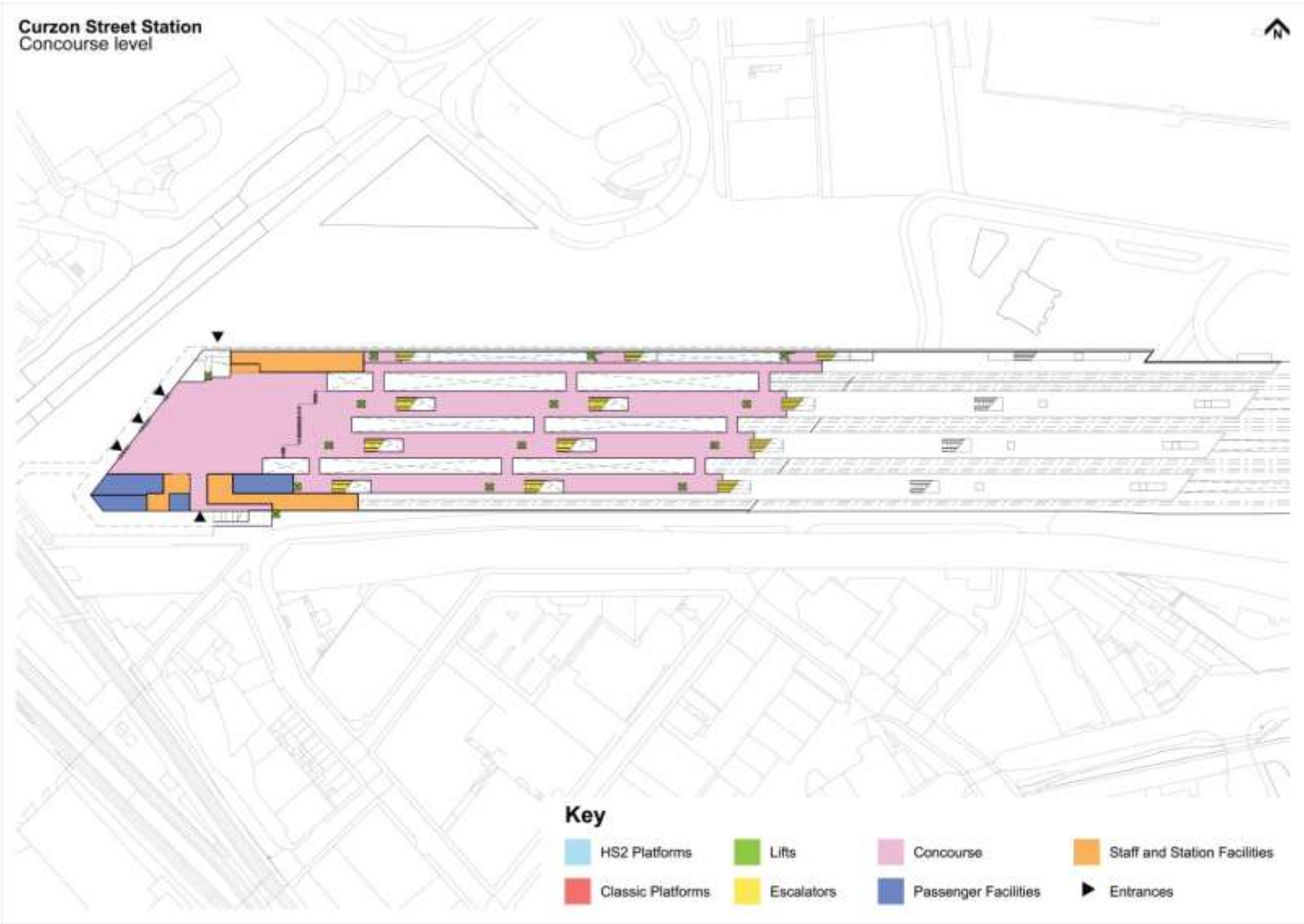


Figure 6: Curzon Street station platform level layout

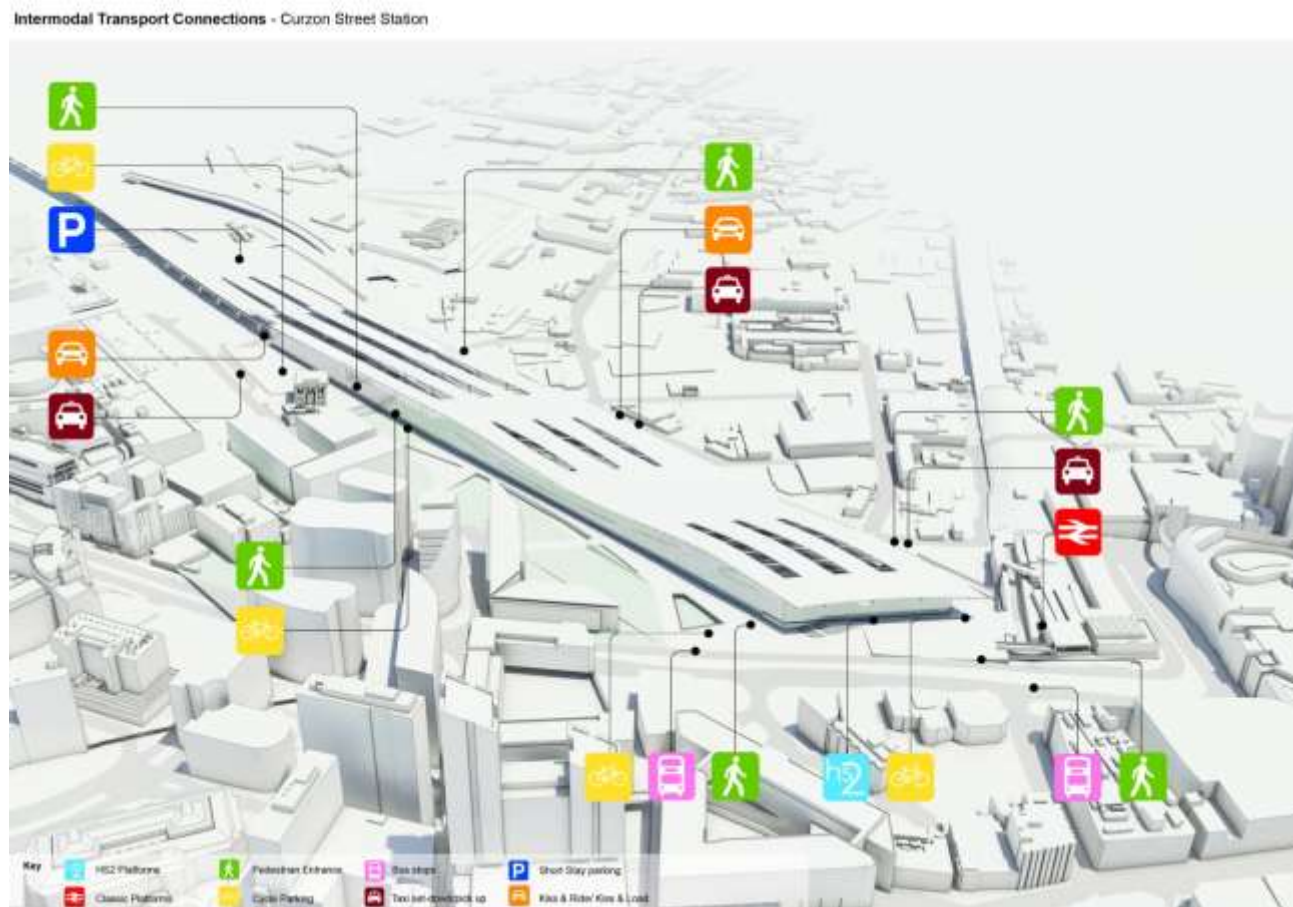


Figure 7: Curzon Street station concourse level layout



- 2.2.43 The design of Curzon Street station will integrate with connections to other transport modes, as shown in Figure 8: Curzon Street station: intermodal connections.

Figure 8: Curzon Street station: intermodal connections



2.3 Construction of the Proposed Scheme

- 2.3.1 This section sets out the strategy for construction of the Proposed Scheme in the Washwood Heath to Curzon Street 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 end of Section 2.3, Figure 11).
- 2.3.2 The assessment presented in this ES is based on the construction arrangements as described in this section.
- 2.3.3 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 in the Volume 2: Maps CT-05-138b to CT-05 142. 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.

- 2.3.4 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

- 2.3.5 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 and preliminary enabling works;
- civil engineering works, including: establishment of construction compounds; site preparation and enabling works; main earthworks and structure works; boring of the two tunnels; site restoration; and removal of construction compounds;
- railway installation works, including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; removal of construction compounds; and
- system testing and commissioning.

- 2.3.6 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

- 2.3.7 General information about advance works can be found in Volume 1, Section 6.4. Advance works will be required before commencing construction works and will typically include:

- further detailed site investigations and surveys;
- further detailed environmental surveys;
- advance mitigation works, including where appropriate contamination remediation, temporary habitat creation and archaeological field evaluation;
- land possession;
- site establishment with temporary fence construction; and

- utility diversions.

Engineering works

- 2.3.8 Construction of the railway will require engineering works along the entire length of the route, and within land adjacent to the route. This will comprise two broad types of engineering work:
- civil engineering works, such as earthworks and erection of bridges and viaducts; and/or
 - railway installation works, such as laying ballast or slabs and tracks, and/or installing power supply and communications features.
- 2.3.9 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.
- 2.3.10 In the Washwood Heath to Curzon Street area there will be 13 construction compounds. These will comprise two main compounds, nine civil engineering satellite compounds and six railway installation satellite compounds (of which four will continue to use compounds previously established for the civil engineering works).
- 2.3.11 Figure 9 shows the management relationship for civil engineering works compounds and Figure 10 for the railway installation works compounds. Details for the individual compounds are provided in subsequent sections of this report.

General overview of construction compounds

- 2.3.12 Main compounds will be used for core project management staff (i.e. engineering, planning and construction delivery), and commercial and administrative staff. These management teams will directly manage some works and/or coordinate satellite compounds, which will manage other works. In general, main compounds will contain:
- space for the storage of bulk materials (aggregates, structural steel and steel reinforcement);
 - space for the receipt, storage and loading/unloading of excavated material either onto or off the site;
 - an area for the fabrication of temporary works equipment and finished goods;
 - 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.

- 2.3.13 Satellite compounds will be used as the base to manage specific works along a section of the route. They will usually provide office accommodation for limited numbers of staff, local storage for plant and materials, limited car parking for staff and site operatives, and welfare facilities.
- 2.3.14 Some compounds will also accommodate additional functions. Where this is the case they will be included in the description of the compound. Roadheads will require an additional area of land adjacent to the compound for the storage, loading and unloading of bulk earthworks materials which are moved to and from the site on public highways.
- 2.3.15 In addition, areas adjacent to some compounds will be used for the storage of topsoil stripped as part of the works prior to it being used when the land is reinstated to its former use.
- 2.3.16 Further information on the function of compounds, including general provisions for their operation, including security fencing, lighting, utilities supply, site drainage, codes of worker behaviour are set out in Volume 1, Section 6.6, and the draft CoCP, Section 5.

Construction traffic routes

- 2.3.17 The movement of construction vehicles carrying materials, plant, other equipment and workforce (or moving empty) will take place both within the construction sites, on public roads and via the rail network. The construction compounds will provide the interface between the construction works and the public highway or rail network, and the likely road routes to access compounds are described in subsequent sections below.
- 2.3.18 Movements between the construction compounds and the work sites will be on designated haul roads within the site, often along the line of the new railway or running parallel to it.

Figure 9: Schematic of construction compounds for civil engineering works

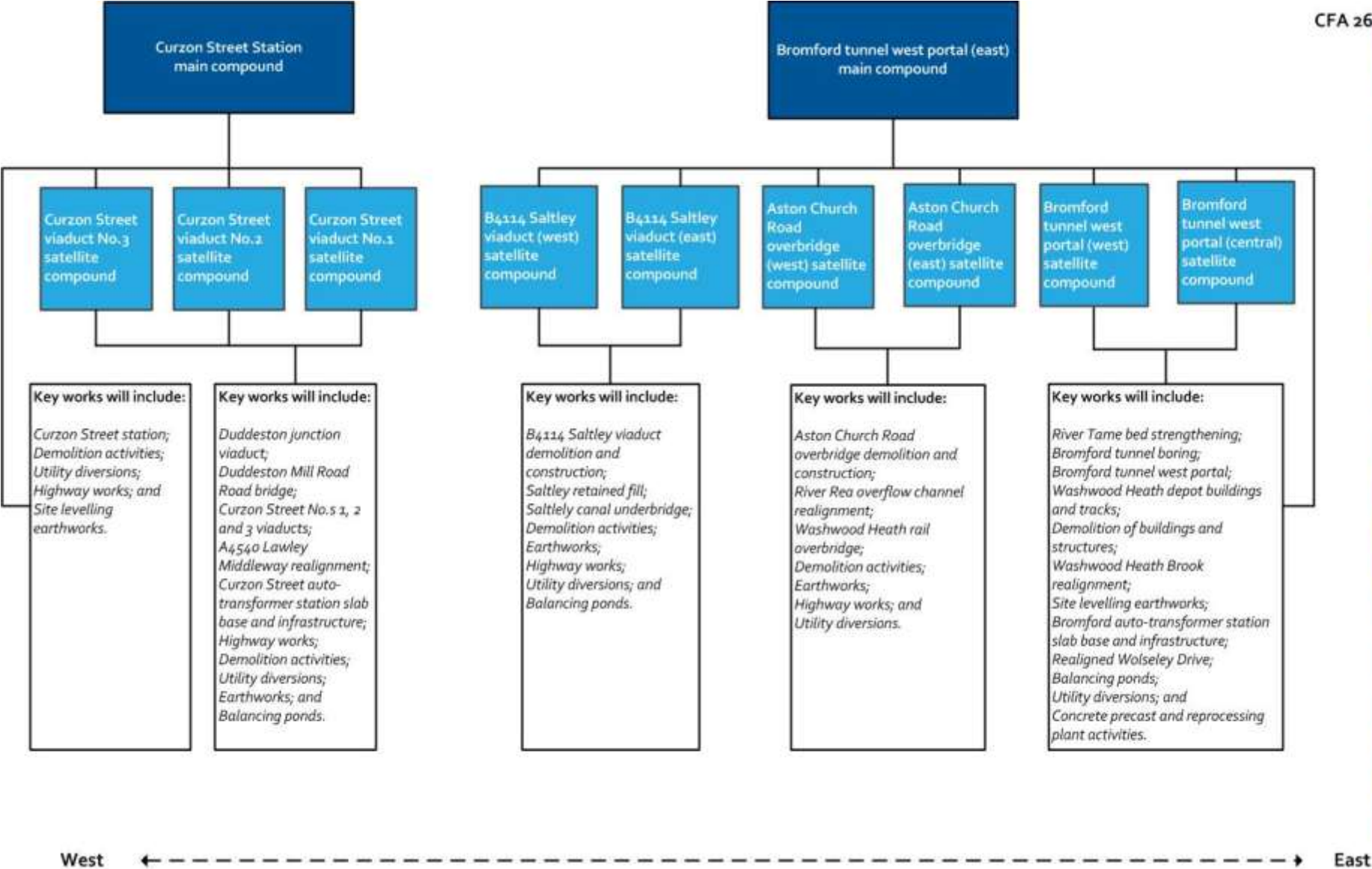
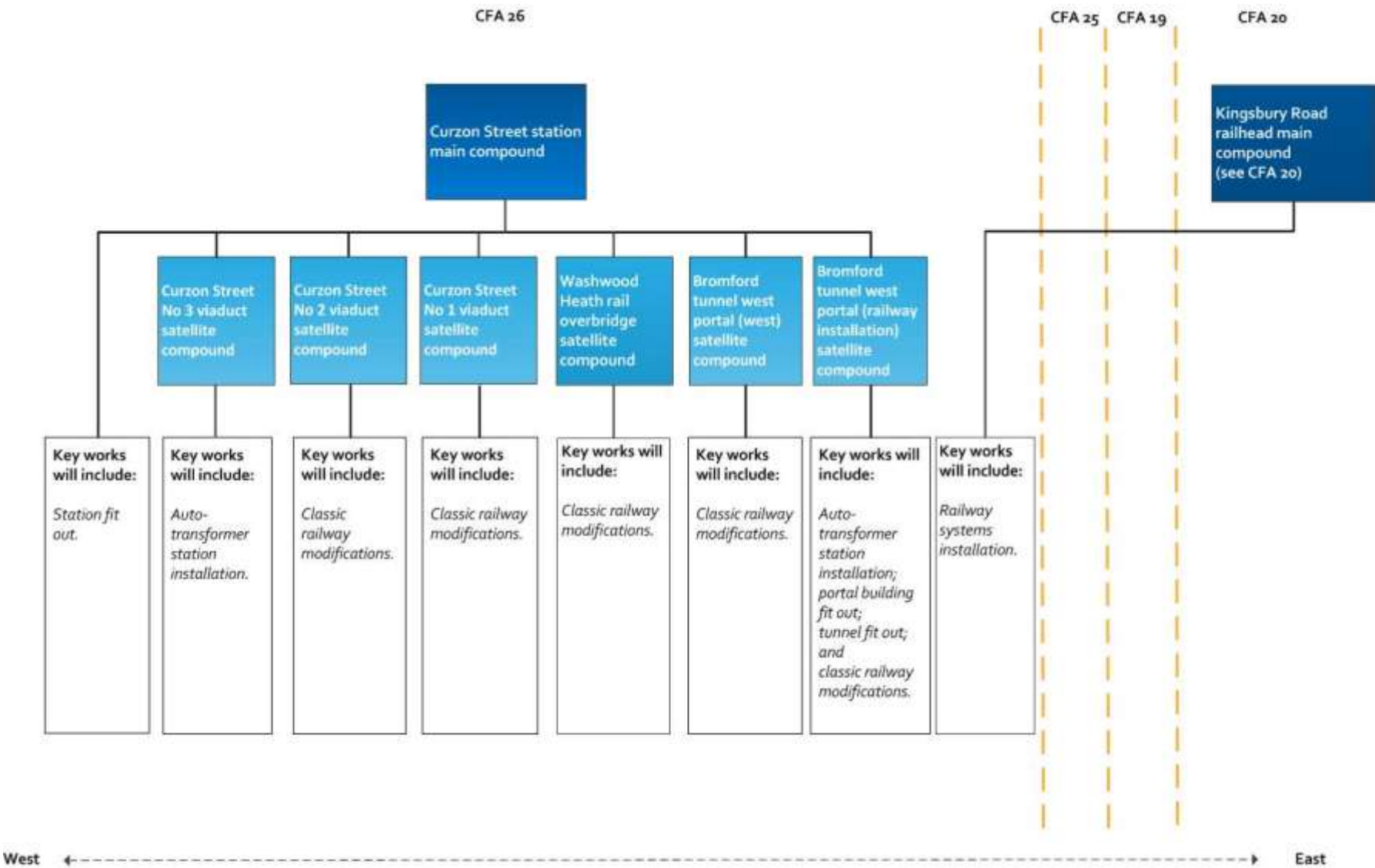


Figure 10: Schematic of construction compounds for railway installation works



- 2.3.19 The information below describes the works to be undertaken from both the civil engineering compounds and then the railway installation compounds. Where railway installation works are to be undertaken from a civil engineering compound, the works are described under the civil engineering description.

Bromford tunnel west portal (east) main compound, Bromford tunnel west portal (central) satellite compound and Bromford tunnel west portal (west) satellite compound

- 2.3.20 The construction works in the eastern part of this area, from Bromford Lane to the B4114 Saltley Viaduct, will be managed from the Bromford tunnel west portal (east) main compound (Volume 2: Map CT-05-139b, H7). This compound will provide support to six satellite compounds, as illustrated in Figure 9, particularly for the key works of the boring of the Bromford tunnel and the construction of the new Washwood Heath depot.
- 2.3.21 Two of the six satellite compounds mentioned above will be located close to the Bromford tunnel west portal (east) main compound. Bromford tunnel west portal (central) satellite compound (Volume 2: Map CT-05-139b, E8) and Bromford tunnel west portal (west) satellite compound (Volume 2: Map CT-05-139b, B6) will be managed from the Bromford tunnel west portal (east) main compound and will additionally support the work to the Bromford tunnel west portal and depot works. One of these compounds, Bromford tunnel west portal (west) will also be used for rail fit-out works (the other rail fit-out satellite compound in this area, Bromford tunnel west portal (railway installation) satellite compound, is described separately later in this section).
- 2.3.22 These three compounds will:
- be operational for civil engineering works for approximately five years and nine months, commencing in 2017;
 - the Bromford tunnel west portal (west) satellite compound will be operational for rail fit-out works for approximately seven years and six months commencing in 2017. Consequently the civils and rail fit-out works will be undertaken at the same time from this compound for approximately five years and six months;
 - support up to approximately 230 civil engineering workers at Bromford tunnel west portal (east) main compound and 140 workers at each of Bromford tunnel west portal (central) and (west) satellite compounds (510 in total for all three compounds) each day throughout the civil engineering works period. There will be approximately an additional 10 rail fit-out workers at the Bromford tunnel west portal (west) satellite compound;
 - not provide temporary worker accommodation (there is no temporary worker accommodation in this area; some workers may be able to use the temporary worker accommodation at the proposed Birmingham Interchange station site, see CFA24);
 - have temporary material stockpile areas at Bromford tunnel west portal (central) and (west) satellite compounds;

- a material processing centre, a logistics centre and roadhead will be included at the Bromford tunnel west portal (central) satellite compound;
- a concrete batching plant will be included at the Bromford tunnel west portal (west) satellite compound; and
- be accessed from Wolseley Drive, off the A4040 Bromford Lane, for both the Bromford tunnel west portal (east) main compound and Bromford tunnel west portal (central) satellite compound. The Bromford tunnel west portal (west) satellite compound (both civils and rail fit-out) will be accessed from Aston Church Road and the access bridge directly off the A47 Heartlands Parkway (until it is demolished as part of the works). A temporary haul road will be constructed within the construction area from Wolseley Drive to Aston Church Road and connecting to the access bridge off the A47 Heartlands Parkway.

2.3.23 Works managed from these compounds will be carried out in the following broad phases:

- site clearance and enabling works (including demolition of an access bridge off the A47 Heartlands Parkway and the buildings on the proposed depot site);
- diversion of utilities;
- permanent realignment of Washwood Heath Brook and a temporary narrowing and in-channel works of the River Tame to allow for channel bed strengthening works, along with culverts and drainage works;
- construction of three balancing ponds;
- site excavation and levelling earthworks to create a level depot platform area;
- excavation of cutting and construction of Bromford tunnel west portal retaining walls;
- construction of tunnel portal structure, and retaining walls and associated buildings, including the headhouse;
- construction of the depot buildings and rail infrastructure, including the carriage wash plant and storage and plant room to the south of the depot;
- boring of the Bromford tunnel from this site to the Bromford tunnel east portal in the Castle Bromwich Business Park (see CFA25);
- construction of the Bromford auto-transformer station base, depot switch station and infrastructure including access road and underground utilities such as electricity and telephone lines;
- realignment of Wolseley Drive;
- permanent fencing;
- laying of depot trackwork; and
- reinstatement, planting and landscaping (particularly on the south side closest to housing and educational facilities along Warren Road).

- 2.3.24 The Bromford tunnel west portal (east) main compound will be used to manage the construction of the Bromford tunnel, of which approximately 0.7km of the tunnel length lies in this CFA. The tunnel boring machine will be driven from the Washwood Heath site and the tunnel excavated materials will also be removed from this end. The tunnel construction technique, as described in Volume 1, Section 6.12, will be adopted. The tunnelling is likely to generate around 883,000 cubic metres of spoil, of which 701,000 cubic metres will be generated through excavation and tunnelling at the Washwood Heath site.
- 2.3.25 A small gauge tunnel temporary construction railway will form an essential part of the tunnel boring machine logistics and support system; supplying the machines with tunnel lining segments and other consumables using rail mounted vehicles. This railway will be twin tracked from the Washwood Heath site, through the tunnel in this and also the adjacent Castle Bromwich and Bromford area (CFA 25), to enable two-way traffic and servicing of cross passage construction.
- 2.3.26 The main compound will also be used to manage the construction of the cutting for the Bromford tunnel west portal and the associated retaining walls (Volume 2: Map CT-06-139b, H5), which will take approximately three years to construct, commencing 2018. The piling and also the tunnels construction techniques, described in Volume 1, Sections 6.11 and 6.12 will be used for these activities.
- 2.3.27 The majority of excavated material that will be generated in the Washwood Heath to Curzon Street area is expected to be suitable for beneficial reuse as engineering fill material or in the environmental mitigation earthworks of the Proposed Scheme, either within this area or elsewhere along the route. The construction of the Proposed Scheme within the Washwood Heath to Curzon Street area may be able to beneficially incorporate selected types of excess excavated material from the nearby CFAs, if additional material is necessary. There may also be opportunities for selected types of excess excavated material within the Washwood Heath to Curzon Street area to be used within other areas.
- 2.3.28 The Bromford tunnel west portal (central) satellite compound will manage a materials processing centre adjacent to the compound. The materials processing centre will be used to sort, process and recycle (by crushing and screening to produce graded materials) of site won demolition materials and aggregates for reuse within the works. It will also be used to temporarily store and process (when required) earthworks material prior to their reuse within the Proposed Scheme.
- 2.3.29 A logistics centre, located adjacent to the materials processing centre (Volume 2: Map CT-05-139b, centred on F8) will be used to store construction materials for works along the route and also for at Curzon Street station, where storage space will be limited, prior to and during the depot itself being built. This area will also store a temporary earthworks stockpile and act as a roadhead for the works along the route in the Washwood Heath to Curzon Street area.
- 2.3.30 A concrete batching plant (Volume 2: Map CT-05-139b, C5) to supply concrete and a concrete pre-casting facility to manufacture concrete elements such as tunnel segments and bridge beams will be located to the east of the Bromford tunnel west portal (central) satellite compound. The existing concrete batching plant and pre-casting facility will initially be retained for use for the Proposed Scheme. This will then

be replaced by an adjacent new facility as the route alignment passes through the existing facility.

- 2.3.31 The Bromford tunnel west portal (central) satellite compound will manage the demolition of the access bridge from the A47 Heartlands Parkway to the Washwood Heath depot site.
- 2.3.32 The Bromford tunnel west portal (west) satellite compound will manage the construction of the Washwood Heath depot, which will comprise the building of the maintenance shed and workshops, stabling sidings, wheel lathe and plant room, office and training facilities, external works (e.g. car parking, landscaping), track-laying to form the Washwood Heath depot sidings and access roads.
- 2.3.33 The Washwood Heath depot will take approximately five years and nine months to build commencing 2018.
- 2.3.34 Earthworks will be required to lower the level of the proposed Washwood Heath depot site in the western section and to raise the level in the eastern section to create a level platform for the depot trackwork and buildings. The excavated material from the western section may require some on-site processing and on-site storage before it can be transported off-site by road. The fill material for the eastern section of the site will come from the excavated material from the Bromford tunnel and the Bromford tunnel west portal works, if it is suitable for engineering use, along with some additional suitable fill materials which are likely to be required to be imported.
- 2.3.35 A simplified construction sequence for the Washwood Heath depot has been developed as follows:
- Phase 1: enabling works will be carried out in advance of the main construction works including; site investigation works, installing monitoring equipment, archaeological works and utility diversions;
 - Phase 2: establishment of the site compound, access points, haul roads and perimeter fencing. Excavation would commence with stripping of topsoil and removal of any remaining hardstandings. Demolition of structures and site clearance activities will be undertaken in this phase;
 - Phase 3: installation of piles, deep excavations for the inspection/drop pits and shallower excavations for the pile caps, ground beams and ground slabs. Once excavated, substructure blinding, pile breakdown, reinforcement fixing, shuttering and placing of concrete will follow;
 - Phase 4: the buildings will likely be steel frame structures. The steelwork will be fabricated off-site and delivered in sections to allow assembly and erection on-site. The steel frame will typically be erected in bays using tower cranes and mobile elevated working platforms;
 - Phase 5: installation of cladding panels to form the exterior walls;
 - Phase 6: installation of the roof;
 - Phase 7: preparation of exterior areas to commence track works within the depot areas. First stage track drainage such as carrier drains and chambers will

be laid and the area backfilled. A compacted gravel layer will be laid to form a suitable platform for vehicles to work from to lay temporary tracks. Bottom ballast will then be placed. The permanent rail will then be delivered in long lengths and laid out prior to lifting in panels of sleepers. A rail threader will then place the rails on the sleepers where they will be clipped into position. The rail joints will then be welded and the top ballast placed around the sleepers. A tamper unit will then lift and compact the track to the required level. Some in-situ concrete might be required around the track in certain locations within the depot;

- Phase 8: installation of mechanical, electrical and power systems;
- Phase 9: internal building finishes including internal cladding, blockwork walls, windows, doors, flooring, ceilings; and
- Phase 10: external works, such as paving, placement of bollards, and demobilisation of construction compounds.

- 2.3.36 The Network Rail Duddeston Down through track (Volume 2: Map CT-06-139b, E5), which will take approximately one year to construct, and commence in 2019, will also be managed from the Bromford tunnel west portal (west) satellite compound. The interfaces with the classic rail network during construction technique, described in Volume 1, Section 6.25, will be adopted.
- 2.3.37 The construction, as civil engineering works, of the base and infrastructure for the Bromford auto-transformer station (Volume 2: CT-05-139b, I5) will be managed from the Bromford tunnel west portal east (main) compound. This will take approximately six months to construct commencing 2022. Following this, the auto-transformer will be installed as part of the rail fit-out works as described later in this section under Bromford tunnel west portal (railway installation) satellite compound.
- 2.3.38 The construction of three balancing ponds (Volume 2: Map CT-06-139b, H6, F7 and E7) will be managed from these satellite compounds.
- 2.3.39 Demolition of the existing access bridge structure off the A47 Heartlands Parkway (Volume 2: Map CT-05-139b, E4) will be required. The road will be used as a site access point until its demolition. These works will take nine months commencing 2018 and will require an abnormal possession¹⁶ of the underneath Birmingham and Derby line. These works will be managed by the Bromford tunnel west portal (central) satellite compound.
- 2.3.40 Demolitions will be required for the following properties:

Table 1: Demolitions at Bromford Tunnel west portal (east) main compound, Bromford tunnel west portal (central) satellite compound and Bromford tunnel west portal (west) satellite compound

Description	Location
Twelve residential properties	127 – 149 Common Lane, Washwood Heath
Outbuilding and disused railway rolling stock buildings covering 11 buildings and structures	Common Lane, former Alstom works site, Washwood Heath

¹⁶ Abnormal possession is a non-standard (i.e. outside the usual working hours) suspension of the railway whilst works are undertaken.

Description	Location
Distribution centre: comprising warehouse, offices, two gatehouses and substation	UK Mail Ltd, Express House, Wolsley Drive, off A4040 Bromford Lane, Washwood Heath
Single storey brick warehouse	151-157 Common Lane, Washwood Heath
Concrete and tarmac batching plant: comprising 14 buildings and structures, including two single storey steel frame open storage structures, one steel frame hopper and conveyor, three single storey steel frame warehouses, one steel frame silo, storage tanks, three single storey brick warehouses/storage buildings, one single storey brick office and one two storey brick office	290 Aston Church Road, Washwood Heath
Single-storey brick gatehouse	Adjacent to access bridge from A47 Heartlands Parkway

- 2.3.41 Although no main utility works will be required in this area, a number of smaller utility diversions will be required. The utility construction technique in Volume 1, Section 6.4, will be adopted. A key utility diversion in this area is a 900mm diameter foul sewer diversion. This will be an approximately 530m long permanent diversion around the proposed Washwood Heath depot maintenance shed.
- 2.3.42 No alternative routes for footpaths, cycleways or bridleways will be required.
- 2.3.43 In this area, permanent realignment of one watercourse, the Washwood Heath Brook, will be required and this work will be undertaken from the Bromford tunnel west portal (east) main compound. This will be an approximately 950m long permanent realignment of Washwood Heath Brook around the southern perimeter of the proposed Washwood Heath depot. These works will commence in 2017 and take approximately nine months to complete. The drainage and watercourse realignments construction technique, as described in Volume 1, Section 6.9, will be adopted.
- 2.3.44 The River Tame river bed strengthening concrete slab will be installed (Volume 2: Map CT-05-139b, I5). These works are likely to be carried out in phases with the River Tame diverted into a narrowed channel whilst construction works take place in the adjacent section behind a sheet piled cofferdam or similar. This is likely to require some temporary raising of the upstream river walls to prevent flooding whilst these works are being carried out.
- 2.3.45 In addition to the civil engineering works described above, the Bromford tunnel west portal (west) satellite compound will also undertake rail installation works. These will include fit-out of the Bromford tunnel, tunnel equipment, concrete slab and ventilation fans, and modifications to the existing Birmingham and Derby line. These rail installation works will take approximately two years, commencing in approximately 2022.

Aston Church Road overbridge (east) and Aston Church Road (west) satellite compounds

- 2.3.46 These two satellite compounds (Volume 2: Map CT-05-140, F6 and F5 respectively) will be used for civil engineering works between the western end of the proposed Washwood Heath depot and Saltley Business Park and will be managed from Bromford tunnel west portal (east) main compound.
- 2.3.47 These two satellite compounds will:

- be operational for approximately four years and six months at Aston Church Road overbridge (east) and approximately five years and three months at Aston Church Road overbridge (west), both commencing approximately 2017;
- support approximately up to 25 workers at Aston Church overbridge (east) satellite compound and 15 workers at Aston Church overbridge (west) satellite compound each day;
- not provide temporary worker accommodation; and
- be accessed from Aston Church Road for Aston Church Road overbridge (east) satellite compound and from A47 Heartlands Parkway for Aston Church Road overbridge (west) satellite compound. There will be a haul road within the construction area through Saltley Business Park linking Aston Church Road with the B4114 High Street (just to the east of B4114 Saltley Viaduct).

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

- site clearance and enabling works including utilities diversions;
- building and structure demolition;
- cuttings and embankments;
- construction of the new Aston Church Road overbridge;
- demolition of the existing Washwood Heath rail overbridge;
- construction of the new Washwood Heath rail overbridge;
- demolition of existing Aston Church Road overbridge;
- diversion of the River Rea overflow channel; and
- reinstatement, planting and landscaping.

2.3.49 The Aston Church Road overbridge (east) satellite compound will manage the offline replacement of the Aston Church Road overbridge, which will take approximately one year and six months to construct, commencing 2020. Offline replacement allows the traffic to still use the existing bridge while the proposed bridge is constructed alongside, avoiding the need to close Aston Church Road during the works for long periods. There will, however, be approximately either six weekends or 30 overnight closures for utility works and setting the crane up to lift the beams in. The bridges construction technique, described in Volume 1, Section 6.17, will be adopted. This is likely to require an abnormal possession of the Birmingham and Derby line. Modifications and protection works to the existing railway network to facilitate the bridge replacement works will be required.

2.3.50 This compound will also manage the online construction of the Washwood Heath rail overbridge (which will replace part of the existing structure that carries the Stechford and Aston line) over the route. This activity will take approximately nine months to complete, commencing 2017. This online replacement requires the proposed bridge deck to be built alongside or adjacent to the existing structure and then slide, or be transported, into place once the existing structure is demolished and substructure

erected. This is likely to require an abnormal possession of the Birmingham and Derby line and a longer abnormal possession of the Stechford and Aston line.

2.3.51 Demolitions of nine commercial properties will be required at:

- Unit 1, Aston Church Road, Saltley Business Park;
- Unit 5, Cumbria Way, Saltley Business Park;
- Units R, 3, 4, 5 and 6 on Dorset Road, Saltley Business Park (adjacent to the Birmingham and Derby line); and
- Unit 1 and 2 Pennine Way, Saltley Business Park.

2.3.52 During construction, diversions of utilities will be required. The utility construction technique in Volume 1, Section 6.4, will be adopted. The key diversions in this area include:

- a 600mm diameter high pressure gas main, for approximately 390m in length, along the southern side of the A47 Heartlands Parkway from near Nechells Gas Holder to north of the Birmingham and Derby line in Saltley (Volume 2: Map CT-05-140 G5 to E5);
- a 825mm diameter combined sewer approximately 530m in length parallel to the Birmingham and Derby line, north of the route in an east to west direction;
- nineteen existing 11kv high voltage electricity cables. The existing cables will be decommissioned and removed and replaced by a diversion, approximately 1.5km long, which will run from Duddeston Mill Road, along Pembroke Way, Clayton Road, Washwood Heath Road, Adderley Road and Cranby Street to the new Aston Church Road overbridge;
- a 400mm diameter medium pressure gas main, a 400mm diameter water main and telecommunication cables that currently pass under Aston Church Road bridge. These will be diverted from the existing bridge onto the new Aston Church Road overbridge;
- a 675mm diameter combined sewer, for approximately 230m in length, south-west of Aston Church Road within Saltley Business Park;
- a 525mm diameter combined sewer, for approximately 110m in length, south-west of Aston Church Road within Saltley Business Park; and
- a 450mm diameter surface water sewer, for approximately 80m in length, in an east to west direction to the south-west of Aston Church Road.

2.3.53 Temporary weekend and night-time lane closures of the A47 Heartlands Parkway will be required whilst construction of under-road culverts take place. This will take place over approximately one year and three months. The drainage and watercourse realignments construction technique, as described in Volume 1, Section 6.9, will be adopted. Local temporary re-routing of pedestrian routes using the A47 Heartlands Parkway will be required over this period.

- 2.3.54 The Aston Church Road overbridge (west) satellite compound will manage the permanent diversion of approximately 670m of the River Rea Overflow Channel (see Volume 2: Map CT-06-140, E5 to H5 for proposed realignment). These works will commence in 2021 and take approximately one year and three months to complete. The drainage and watercourse realignments construction technique, as described in Volume 1, Section 6.9, will be adopted.
- 2.3.55 In this area, earthworks will be undertaken to lower the level of the ground for the route to pass under the Washwood Heath rail overbridge and Aston Church Road overbridge. The excavated material may require some on-site processing and on-site storage before it can be transported by road.

B4114 Saltley viaduct (west) and B4114 Saltley viaduct (east) satellite compounds

- 2.3.56 These two satellite compounds (Volume 2: Map CT-05-140, C6 and C7 respectively) will provide directly for engineering works within the Saltley area and will be managed from the Bromford tunnel west portal (east) main compound. These satellite compounds will:
- be operational for approximately three years at B4114 Saltley viaduct (east) and approximately two years and three months at B4114 Saltley viaduct (west), both commencing approximately 2017;
 - support approximately 50 workers each day at B4114 Saltley viaduct (east) satellite compound and approximately 20 workers each day at B4114 Saltley viaduct (west) satellite compound and throughout much of this period;
 - not provide temporary workers accommodation; and
 - be accessed from B4114 Saltley Viaduct for B4114 Saltley viaduct (east) satellite compound and A47 Heartlands Parkway for B4114 Saltley viaduct (west) satellite compound. There will be a haul road in the construction area through Network Park industrial estate linking the B4114 High Street to Duddeston Mill Road.
- 2.3.57 Works in this section of the Proposed Scheme will be carried out in the following broad phases:
- site clearance and enabling works including utilities diversions;
 - building and structure demolition, including at Network Park industrial estate;
 - construction of Saltley canal underbridge;
 - demolition of the existing and construction of the replacement B4114 Saltley viaduct;
 - construction of Saltley retained fill;
 - construction of balancing ponds; and
 - highway reinstatement, planting and landscaping.

- 2.3.58 These satellite compounds will manage the online replacement of the B4114 Saltley Viaduct. B4114 Saltley Viaduct will be temporarily closed during construction for approximately one year and six months, commencing 2018. Duddeston Mill Road and Aston Church Road will remain open during these works (although both of these roads have bridges that will be subject to works at other times) to provide alternative traffic routes during the closure. The bridges construction technique, as described in Volume 1, Section 6.17, will be adopted. Utilities will be diverted from the existing B4114 Saltley Viaduct before it is demolished. Highway works will be completed after the new B4114 Saltley viaduct is built to connect the new B4114 Saltley viaduct to the existing roads. These works are likely to require an abnormal possession of the Birmingham and Derby line.
- 2.3.59 Demolitions of three buildings, containing eight commercial properties, will be required:
- a single storey warehouse at TNT, Network Park industrial estate; and
 - two single high storey warehouses at Network Park industrial estate (each warehouse comprises three properties – Units 10, 11, 12 and 13 in one and also Units 14, 15 and 16 in the other).
- 2.3.60 During construction, diversions of utilities will be required. The utility construction technique described in Volume 1, Section 6.5, will be adopted. The key diversions in this area include:
- a 2.8m diameter sewer, for approximately 240m in length, in an east to west direction within Saltley Business Park;
 - a 1.8m diameter sewer, for approximately 380m in length, in a north to south direction within Network Park industrial estate; and
 - four telecommunication cables and two 11kv high voltage electricity cables that pass under B4114 Saltley Viaduct, following the alignment of the road in an east to west direction for approximately 240m. A temporary service bridge will be installed to carry the cables over the Birmingham and Derby line during bridge reconstruction works.
- 2.3.61 There will be a local temporary alternative route for the canal towpath along the Grand Union Canal whilst the Saltley canal underbridge is being constructed. This will take approximately one year and three months to construct, commencing 2017. It is also likely to require temporary weekend or overnight closures of the canal itself to allow installation of the bridge deck beams. The bridges construction technique, described in Volume 1, Section 6.17, will be adopted.
- 2.3.62 Other works include construction of two balancing ponds (Volume 2: Map CT-06-140, C6 and B7) and modifications and protection works to the existing railway network to facilitate the civil engineering works.
- Curzon Street No.1 viaduct satellite compound, Curzon Street No.2 viaduct satellite compound and Curzon Street No.3 viaduct satellite compound*
- 2.3.63 These three satellite construction compounds (Volume 2: Map CT-05-141, H7, D6 and B6 respectively) will provide support for the civil engineering and railway installation

works from Duddeston Mill Road in Duddeston to Curzon Street and will be managed from Curzon Street station main compound. These satellite compounds will:

- be operational for approximately five years and nine months at Curzon Street No.1 viaduct satellite compound, approximately three years and six months at Curzon Street No.2 viaduct satellite compound and approximately three years and six months at Curzon Street No.3 viaduct satellite compound, all commencing approximately 2017. All three of these sites will also be used for rail fit-out works, although many of these works will be concurrent with the civil engineering construction, except for Curzon Street No.3 viaduct which will be operational for one year and nine months after the civil engineering works, from middle of 2022 up until early 2024;
- support approximately 40 workers each day during civil engineering works at Curzon Street No.1 viaduct satellite compound; up to approximately 30 workers each day at Curzon Street No.2 viaduct satellite compound and up to approximately 80 workers each day at Curzon Street No.3 viaduct satellite compound;
- support approximately 85 workers each day during railway installation works at Curzon Street No.1 viaduct satellite compound, 20 workers each day at Curzon Street No.2 viaduct satellite compound, and 25 workers each day at Curzon Street No.3 viaduct satellite compound;
- provide no temporary worker accommodation;
- have temporary material stockpile area adjacent to Curzon Street No.1 viaduct (Volume 2: Map CT-05-141, G6) and also south of Curzon Street No.3 viaduct satellite compound (Volume 2: Map CT-05-141, B7); and
- be accessed from Duddeston Mill Road for Curzon Street No.1 viaduct satellite compound, Erskine Street for Curzon Street No.2 viaduct satellite compound, and Curzon Street for Curzon Street No.3 viaduct satellite compound. There will be a haul road through the construction area linking Duddeston Mill Road with Erskine Street and then onto A4540 Lawley Middleway.

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

- site clearance and enabling works including utilities diversions;
- building and structure demolitions;
- construction of Duddeston Junction viaduct, Curzon Street No.1, Curzon Street No.2 and Curzon Street No.3 viaducts;
- demolition and construction of new Duddeston Mill Road bridge;
- highway works to the A4540 Lawley Middleway;
- construction of balancing ponds;
- Curzon Street auto-transformer station base, infrastructure (including access road and utilities – electricity and telephone lines, both buried) and fit-out;

- existing railway realignment, railway installation works; and
- reinstatement, planting and landscaping.

- 2.3.65 Curzon Street No.1 viaduct satellite compound will manage the construction of Duddeston Mill Road bridge (Volume 2: Map CT-05-141, H6), which will take approximately nine months to build commencing 2017. Duddeston Junction viaduct, which will commence construction in 2019 and take approximately three years and three months to complete will also be managed from this satellite compound.
- 2.3.66 Track realignment work will be required on the Birmingham and Derby line and sidings near to the Freightliner Terminal Depot. This will require a series of abnormal possessions to enable these track works to be completed along with a series of overnight possessions to allow the construction works to be completed. The bridges construction technique, described in Volume 1, Section 6.17, will be adopted for construction of Duddeston Mill Road bridge. Construction of the Duddeston Junction viaduct will adopt the viaduct construction technique, described in Volume 1, Section 6.16.
- 2.3.67 Curzon Street No.2 viaduct satellite compound will manage the construction of Curzon Street No.1 and No.2 viaducts. The Curzon Street No.1 viaduct will be over the Freightliner Terminal Depot, which will take approximately two years and six months to construct commencing in 2018. These works will be phased and require a short period of night-time working. Curzon Street No.2 viaduct, which will take approximately two years and three months to construct commencing 2017, will also be managed from this compound. The viaduct construction technique, described in Volume 1, Section 6.16, will be adopted.
- 2.3.68 Curzon Street No.3 viaduct satellite compound will manage the construction of Curzon Street No.3 viaduct, which will take approximately two years commencing 2018. The viaduct construction technique, described in Volume 1, Section 6.16, will be adopted. This satellite compound will also manage the construction of the A4540 Lawley Middleway offline realignment, which will take approximately one year and three months to construct commencing in 2018 and installation of the Curzon Street auto-transformer station base and infrastructure, which will commence construction in 2020 and take approximately six months to complete. Curzon Street highway works will be managed from Curzon Street No.3 viaduct satellite compound and will take approximately one year and three months, commencing 2017.
- 2.3.69 The following demolitions in this area will be required:

Table 2: Demolitions at Curzon Street No. 1 viaduct satellite compound, Curzon Street No. 2 viaduct satellite compound and Curzon Street No. 3 satellite compound

Description	Location
Four buildings including one single-storey, brick industrial building, one temporary office, one single-storey brick office and one two-storey office building	Network Rail, Saltley Depot, Duddeston Mill Road, Saltley
Three buildings including two single-storey steel warehouses and a single storey brick office building	Landor Street, Saltley
Single-storey, steel frame, open sided canopy building	Dollman Street, Duddeston

Single-storey, steel sheet, industrial building	Inkerman Street, adjacent to the River Rea, 90m south of Alma Crescent, Duddeston
Single-storey brick community building (Arya Samaj Vedic Mission)	Erskine Street, Duddeston
Two-storey brick, industrial building	178 Inkerman Street, Duddeston
Mostly single-storey, brick, industrial building	29 Inkerman Street, Duddeston
Single-storey brick and corrugated iron industrial building	36 Erskine Street, Duddeston
Single-storey, steel frame car park	St James' Place, Nechells
Two-storey steel sheet warehouse, and mostly single-storey brick commercial building	14 Lawford Close, Nechells
Single-storey brick commercial building	10 Lawford Close, Nechells
Two-storey steel sheet warehouse	Lawford House, Lawford Close, Nechells
Two-storey concrete commercial building	Unit 1 and Unit 2, Lawford Terrace, Nechells
Student halls of residence, two multi-storey, concrete residential buildings	Curzon Gateway student accommodation, 36 Curzon Street.

- 2.3.70 In addition to these demolitions, there will be a permanent loss of access for commercial property at 28 Viaduct Street and temporary loss, during construction for properties at 1-6 Locke Place (off St James' Place), Nechells.
- 2.3.71 During construction, diversions of utilities will be required. The utility construction technique described in Volume 1, Section 6.4, will be adopted for these diversions. The majority of diversions within this area will be for the highway works to Curzon Circle, which will divert existing utilities around the new Curzon Circle alignment. The key diversions include:
- a 1.1m diameter water main, a 600mm diameter water main, two 400mm diameter water mains and a 300mm diameter water main underground electricity and communications cables which will be permanently diverted around Curzon Circle;
 - a 600mm diameter, 450mm diameter and a 375mm diameter sewer; and
 - a total of approximately 460m length of temporary and permanent telecommunications cables.
- 2.3.72 Other diversions within this area include:
- a 1.8m diameter surface water sewer, which will be permanently diverted to the west of Duddeston Mill Road; and
 - a 2.7m diameter sewer, approximately 400m in length along Inkerman Street in an east to west direction.
- 2.3.73 Weekend and overnight closures will be required for the Duddeston Mill Road, over a two year period. Also, temporary lane closures, overnight and weekend road closures of the A4540 Lawley Middleway will be required to allow highway works to both

Curzon Circle and Garrison Circus, including installing new traffic signals at the junctions. The road diversions construction technique, described in Volume 1, Section 6.10, will be adopted.

- 2.3.74 Part of Viaduct Street will be permanently closed to enable the viaduct support piers of the Curzon Street No.2 viaduct (see Volume 2: Map CT-05-141, C7) to be constructed close to the existing Birmingham and Bushbury line viaduct (which will need to be protected as it is Grade II listed) to minimise the span length. Curzon Street No.2 viaduct will cross over the existing Birmingham and Bushbury line viaduct and require a series of overnight possessions of the Birmingham and Bushbury line to allow this and amendments to the existing overhead line equipment.
- 2.3.75 In this area, a local temporary alternative route for the canal towpath along the Digbeth Branch Canal will be required during construction of Curzon Street No.3 viaduct above the canal. The temporary diversion will be a short distance to the east of and parallel to the towpath's current alignment. The canal will likely require temporary weekend or overnight closures to allow installation of the bridge deck beams. The bridges construction technique, described in Volume 1, Section 6.17 will be adopted.
- 2.3.76 Construction of three balancing ponds (Volume 2: Map CT-06-141, G6, E7 and B7) will also be managed from these satellite compounds.
- 2.3.77 The construction of the base and infrastructure and installation of Curzon Street auto-transformer station will also be managed from the Curzon Street No.3 viaduct satellite compound. These works will take approximately six months to complete.

Curzon Street station main compound

- 2.3.78 The construction in the western part of this area for civil engineering, from Duddeston Mill Road to Moor Street Queensway, and all railway installation works in this area will be managed from Curzon Street main compound. During the civil engineering works this main compound will provide support to the three civil engineering satellite compounds (Curzon Street No's 1, 2 and 3 viaduct satellite compounds; see Figure 9) and later to all six railway installation satellite compounds (see Figure 10), particularly for the key works of constructing the Curzon Street station and the viaducts on the approach to it.
- 2.3.79 This main compound will:
- be operational for civil engineering works for approximately five years and nine months, commencing approximately 2017;
 - be operational for rail installation works for three years and six months, commencing approximately 2021. There will an overlap of one year and three months where this compound will accommodate both civil engineering and rail installation works;
 - support approximately 375 workers each day during civil engineering works and 30 workers each day during railway installation works;
 - not provide temporary worker accommodation;

- have a temporary materials stockpile area adjacent to the compound on Curzon Street (Volume 2: Map CT-05-142, H5); and
- be accessed via Curzon Street. There will be a haul road through the construction area from Curzon Street to Moor Street Queensway.

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

- site clearance and enabling works, including utilities diversions;
- earthworks;
- highway works;
- building and structure demolition;
- construction of Curzon Street station;
- railway installation works; and
- reinstatement, planting and landscaping.

2.3.81 The construction of Curzon Street station will take approximately five years to complete, commencing 2018, with another year for fit-out. Areas within the Curzon Street station compound will be used to provide short term storage of materials allowing a just-in-time delivery of materials from the logistics centre located next to the Bromford tunnel west portal (central) satellite compound.

2.3.82 Other works managed from the Curzon Street station compound include earthworks to lower the level of the existing site in the western section and to raise the level in the eastern section and highway works to allow permanent closure of stopped up roads, and repositioning of roads to facilitate the construction of the station and construction of the new sections of road associated with the station. The road diversions construction technique, described in Volume 1, Section 6.10, will be adopted. Construction of Curzon Street station will require the installation of a number of temporary tower cranes to enable the various components to be lifted in place.

2.3.83 Based on the current design detail, a simplified construction sequence for Curzon Street station is proposed to be adopted as follows:

- Phase 1: enabling works will be carried out in advance of the main construction works including; ground investigation works, installing monitoring equipment, archaeological survey works (including removal of graves from Park Street Gardens) and utility diversions (as described below);
- Phase 2: establishment of the construction compound, haul roads, site clearance and excavation of ground. Demolition of one building and modifications to one building (as described below) and site clearance activities will be undertaken in this phase;
- Phase 3: installation of piles, excavation to form the basement and construction of ground beams and basement slabs;
- Phase 4: installation of tower cranes to facilitate placing of pre-cast units;

- Phase 5: lifting of the pre-cast panels into position to form the concrete superstructure up to concourse level consisting of columns, suspended slabs, and walls;
- Phase 6: construction of station steel superstructure up to roof level;
- Phase 7: installation of cladding panels to form the exterior walls;
- Phase 8: installation of the station roof;
- Phase 9: installation of mechanical, electrical and public health systems;
- Phase 10: internal station finishes including internal cladding, blockwork walls, windows, doors, flooring, and ceilings;
- Phase 11: external urban realm including footpaths, block paving, bollards and landscaping; and
- Phase 12: reinstatement, including the removal of haul roads.

2.3.84 During construction, diversions of utilities will be required. The utility construction technique in Volume 1, Section 6.4, will be adopted. A large proportion of the key diversions in this area are around the footprint of Curzon Street station and will involve existing utilities being diverted along New Canal Street including:

- a 1.1m diameter, 400mm diameter and 300mm diameter water mains that pass under Freeman Street, Park Street and Fazeley Street, ranging in distances from approximately 260m to 525m in length;
- a 1.1m diameter sewer under Bartholomew Street, for approximately 310m in length; and
- telecommunications cables under Bartholomew Street, for approximately 350m in length.

2.3.85 The demolition of the Grade II listed Fox and Grapes public house on Freeman Street will be required. In addition, there will be modifications to the locally listed Eagle and Tun public house on New Canal Street to integrate the building within the proposed Curzon Street station structure.

2.3.86 The permanent closure of an unnamed access road off Curzon Street, Banbury Street (from its junction with New Canal Street to the Rugby to Birmingham line), Andover Street (short section from its junction with Banbury Street and the Rugby and Birmingham line), Fazeley Street (west of New Canal Street, north of the Rugby to Birmingham line), Park Street (between Masshouse Lane and Bordesley Street), Seymour Street, Freeman Street and Paternoster Row will be required in order to construct the proposed Curzon Street station.

2.3.87 The fit out of railway systems within Curzon Street station will be managed from this compound. These works will take approximately one year, commencing in approximately 2023. The compound will be retained through the testing and commissioning period, up to approximately end of 2026.

Bromford tunnel west portal (railway installation) satellite compound

- 2.3.88 This satellite compound (Volume 2: Map CT-05-139b, I6) will support rail fit-out works of the installation of the Bromford auto-transformer station and the fit-out of the Bromford tunnel west portal headhouse. This compound will be managed from the Curzon Street main compound. The compound will:
- be operational for approximately two years and three months, commencing in 2021;
 - support approximately 25 workers each day during railway installation works; and
 - be accessed from Wolseley Drive, off the A4040 Bromford Lane.
- 2.3.89 The installation of the Bromford auto-transformer station will take approximately one year and nine months to complete, commencing 2022. The fit-out of Bromford tunnel west portal headhouse, with railway systems equipment, will take approximately two years and three months to complete, commencing 2022.

Washwood Heath rail overbridge satellite compound

- 2.3.90 Washwood Heath rail overbridge satellite compound (Volume 2: Map CT-05-140, G6) will manage the classic rail modifications to the Birmingham and Derby line and Stechford and Aston line to support the civil engineering works for the new Washwood Heath rail overbridge. This compound will be managed from the Curzon Street main compound. This compound will:
- be operational for approximately 12 months, commencing 2017;
 - support approximately 25 workers each day; and
 - be accessed from Aston Church Road.

Kingsbury Road railhead main compound (see CFA20)

- 2.3.91 This compound is not located within the Washwood Heath to Curzon Street area and no works will be directly undertaken from it in this area, but it will provide support to all railway installation works, particularly in open route, as illustrated in Figure 10. See CFA20 Curdworth to Middleton for more information regarding this compound.

Construction waste and material resources

- 2.3.92 Forecasts of the amount of construction, demolition and excavation waste (CDEW) and worker accommodation site waste that will be produced during construction of the Proposed Scheme in the Washwood Heath to Curzon Street area have been prepared and are presented in Volume 5: Appendix WM-001-000.
- 2.3.93 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, either with or without treatment.
- 2.3.94 Based on the mitigation earthworks design approach adopted for the Proposed Scheme, local excess or shortfall of excavated material within the Washwood Heath to Curzon Street area will be managed with the aim of contributing to the overall

balancing of excavated material on a route-wide basis. The overall balance of excavated material is presented in Volume 3, Section 14.

- 2.3.95 The quantity of surplus excavated material originating from the Washwood Heath to Curzon Street area that will require off-site disposal to landfill as excavation waste is shown in Table 3. 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 Washwood Heath to Curzon Street 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.
- 2.3.96 The quantities of demolition, construction and worker accommodation site waste that will be reused, 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%.
- 2.3.97 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 3.

Table 3: Estimated construction, demolition and excavation waste

Waste type	Estimated material quantities that will be generated (tonnes)	Estimated quantity of waste for off-site disposal to landfill (tonnes)
Excavation	3,797,864	136,699
Demolition	619,730	61,973
Construction	289,620	28,962
Worker accommodation site	0	0
TOTAL	4,707,214	227,634

- 2.3.98 The assessment of the likely significant environmental 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 14).

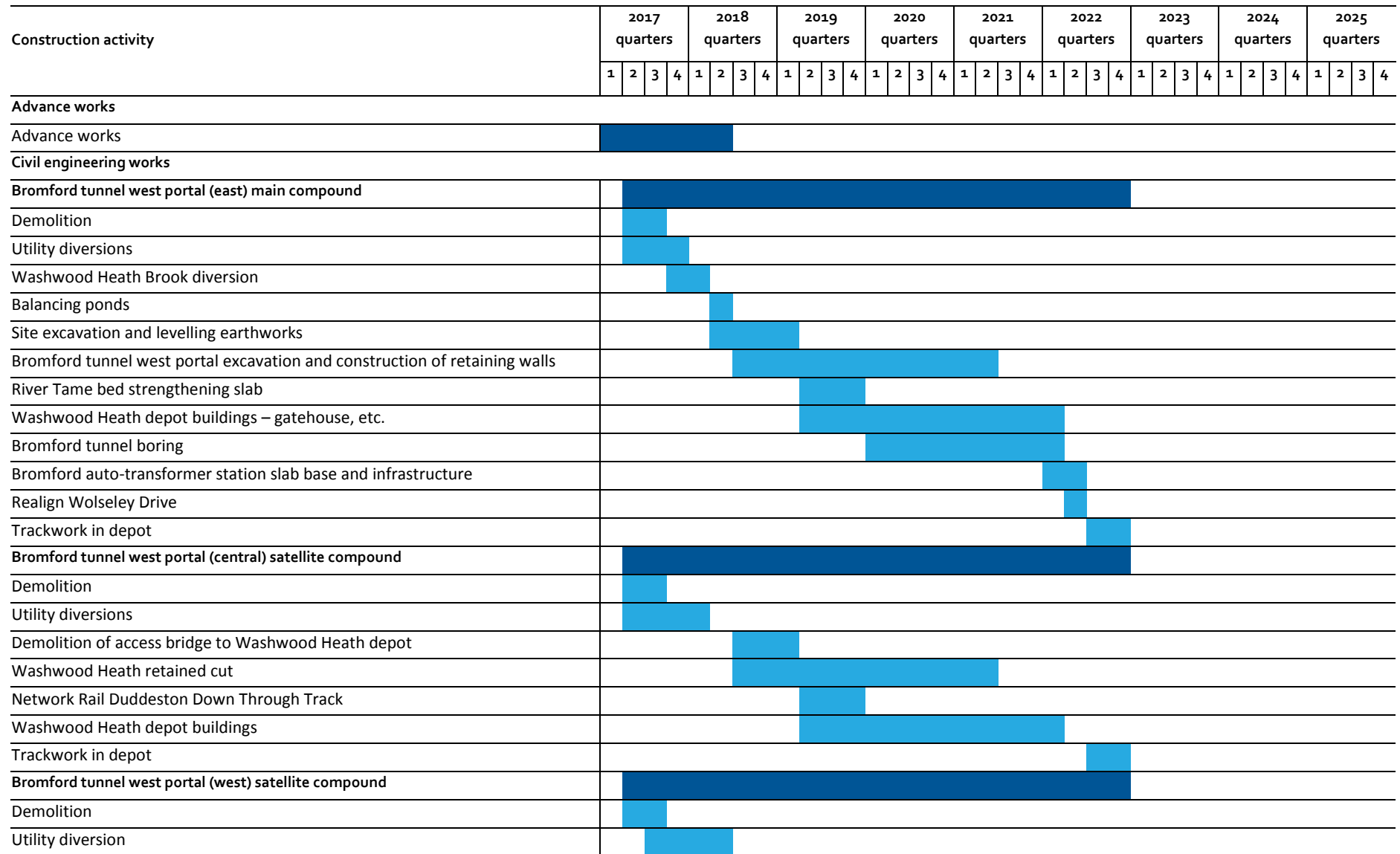
Commissioning of the railway

- 2.3.99 Commissioning is the process of testing the infrastructure to ensure that it operates as expected. This will take place in the year prior to opening. Further details are provided in Volume 1, Section 6.26.

Construction programme

- 2.3.100 A construction programme that illustrates indicative periods for the construction activities in this area is provided in Figure 11: Indicative construction programme.

Figure 11: Indicative construction programme



Construction activity	2017 quarters				2018 quarters				2019 quarters				2020 quarters				2021 quarters				2022 quarters				2023 quarters				2024 quarters				2025 quarters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
Curzon Street No 1 viaduct satellite compound																																				
Classic railway modifications																																				
Curzon Street No 2 viaduct satellite compound																																				
Classic railway modifications																																				
Curzon Street No 3 viaduct satellite compound																																				
Curzon Street auto-transformer station installation																																				
Curzon Street station main compound																																				
Station fit-out																																				
Commissioning																																				
Commissioning (to December 2026)																																				

Key

Construction works

Compound duration

2.4 Operation of the Proposed Scheme

Operational specification

- 2.4.1 Volume 1, Section 4.3 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

- 2.4.2 It is anticipated that initially there will be three trains per hour each way passing through the Washwood Heath to Curzon Street area. All of these HS2 trains will stop at Curzon Street station. HS2 trains will be accelerating away from, or decelerating as they approach, the station; initially, as they come out of the Bromford tunnel, with speeds of 230kph, decreasing in speed as they approach the station. The first scheduled passenger services of the day will leave Curzon Street station no earlier than 05:00 Monday to Saturday (and 08:00 on Sundays) and the last passenger service will arrive no later than midnight. There will be a short period where the empty trains move from the Washwood Heath depot to the Curzon Street station in the morning and then from the station to the depot at night. The station will be open for a short period before and after operating hours to allow for staff and passengers to enter or leave. When required, maintenance will be conducted outside those operating hours.
- 2.4.3 With Phase Two in place, the frequency could rise to nine trains per hour each way during peak hours. The assessment of sound, noise and vibration has taken into account the frequency during Phase Two.
- 2.4.4 The trains will be either single 200m long trains or two 200m long trains coupled together, depending on demand and time of day.
- 2.4.5 The network control centre at the Washwood Heath depot will supervise and control all activities on the entire route in real time.
- 2.4.6 Curzon Street station will provide both domestic and international high-speed rail travel to the public. All passengers will alight at Curzon Street station on arrival to either transfer to other transport services or exit to Birmingham city centre.
- 2.4.7 The station will accommodate public facilities such as waiting areas, ticket machines, information, public toilets and retail, food and beverage outlets. There will also be three station control rooms, on-board staff facilities, management mess rooms and on-board staff mess rooms, as well as staff toilets and changing room facilities.
- 2.4.8 The operation of the Proposed Scheme is described in more detail in Volume 1, Section 4.3.

Maintenance

- 2.4.9 Volume 1, Section 4.3 describes the maintenance regime for HS2.
- 2.4.10 The intention is that inspections of the route will take place on a regular basis, 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.

- 2.4.11 Washwood Heath depot will be a key site for the operations of the Proposed Scheme. All of the HS2 train fleet will have the following servicing and maintenance requirements which will be carried out at Washwood Heath depot:
- overnight internal cleaning;
 - external washing;
 - emptying and replenishing of train toilets at least once every two days;
 - periodic heavy cleaning, approximately once a month;
 - light maintenance (inspections, minor component changes etc.);
 - heavy maintenance (major component change, overhauls, etc.); and
 - periodic tyre turning to maintain the correct safe wheel profile.
- 2.4.12 There will be train movements to and from the Washwood Heath depot, principally as trains enter service at the start of the day, or finish service at the end of the day. There will be additional movements during the day as trains come in and out of service.
- 2.4.13 On arrival, trains will enter Washwood Heath depot where depot staff will take over the train from the main line crew. Train operations at the Washwood Heath depot will be controlled from the depot control centre providing visibility across the site.
- 2.4.14 On leaving the arrivals siding, trains will normally pass through a carriage wash machine. There will be two carriage wash machines at the site to allow for continued site operation in the event of equipment failure. From here, the trains will move on to one of the 20 service sidings, where they will be internally cleaned and have the train toilet facilities flushed and replenished. Servicing tracks will be equipped with walkways for carriage cleaning staff to access inside the trains. Platforms will also be supplied with hot and cold water.
- 2.4.15 Once cleaned, trains will normally be stabled overnight in the sidings before departure in the morning.
- 2.4.16 Accommodation blocks will be provided for maintenance staff, cleaning staff and mainline train crew, who will also be based at the Washwood Heath depot. These facilities will be provided in two office blocks located near the respective working areas.
- 2.4.17 Washwood Heath depot will require different user groups to be on site at various times of the day, with the site operational 24 hours a day, seven days a week. In addition to site operatives, there will also be office-based staff supporting site and network operations. Welfare areas and parking will be required at all hours, as shifts will start and end throughout the day and night.

Operational waste and material resources

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

- 2.4.19 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.
- 2.4.20 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.
- 2.4.21 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.
- 2.4.22 The quantity of operational waste that will be reused, recycled and recovered (i.e. diverted from landfill) has been based on landfill diversion performance information from Network Rail and other sources as follows:
- railway station and trains: 60%;
 - rolling stock maintenance: 80%;
 - track maintenance: 85%; and
 - ancillary infrastructure: 60%.
- 2.4.23 On this basis, approximately 8,605 tonnes of operational waste will be reused, recycled and recovered during each year of operation of the Proposed Scheme in the Washwood Heath to Curzon Street area. Approximately 2,356 tonnes will require disposal to landfill (see Table 4).

Table 4: Operational waste forecast for the Proposed Scheme

Waste source	Estimated quantity of waste generated per annum (tonnes)	Estimated quantity of waste for disposal to landfill per annum (tonnes)
Railway station and trains	836	334
Rolling stock maintenance	10,023	2,005
Track maintenance	94	14
Ancillary infrastructure	8	3
TOTAL	10,961	2,356

- 2.4.24 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).

2.5 Community forum engagement

- 2.5.1 HS2 Ltd's approach to engagement on the Proposed Scheme is set out in Volume 1, Section 3.
- 2.5.2 The engagement undertaken within this 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:
- 27 March 2012 at Saltley Methodist Church;
 - 13 June 2012 at Birmingham City Council Offices, Lancaster Circus Queensway;
 - 24 September 2012 at Phoenix Hall, Bordesley Village;
 - 3 December 2012 at Ward End Library, Ward End;
 - 19 March 2013 at Saltley Methodist Church; and
 - 24 September 2013 at Ward End Library, Ward End.
- 2.5.3 In addition to HS2 Ltd representatives, attendees at these community forum meetings typically included local residents (and residents groups), public representatives, representatives of local authorities and parish and district councils, action groups, affected landowners and other interested stakeholders.
- 2.5.4 The main themes to emerge from these meetings were:
- potential for the Proposed Scheme to increase flood risk, particularly to residential properties;
 - potential temporary diversions for residents during construction of the replacement crossings (such as Aston Church Road and B4114 Saltley Viaduct) and also with both construction impacts and the operational scheme (particularly with street closures in Eastside);
 - potential disturbance to local wildlife;
 - potential noise and vibration effects on local residents;
 - effects on the environment and amenity of Warwick Bar conservation area and Digbeth Branch Canal;
 - effect on heritage assets, particularly the Grade I listed former Curzon Street Station building, the Grade II listed Fox and Grapes public house and locally listed Eagle and Tun public house; and
 - effect of Washwood Heath depot with night-time operational noise and lighting on local residents.
- 2.5.5 In addition to the engagement through the community forums, the draft Environmental Statement and Design Refinement consultations were launched on 16 May 2013 for a period of eight weeks and closed on the 11 July 2013. As part of these consultations, members of local communities 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 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 Washwood Heath to Curzon Street area, consultations on the draft Environmental Statement and on the design refinement were held on 12 June 2013 at Think Tank, Millennium Point on Curzon Street.

- 2.5.6 A wide range of HS2 Ltd staff attended the events, including engineers and environmental specialists, for members of the public to speak to.
- 2.5.7 Responses from the draft ES consultation have been analysed and an overview of those received and how the ES has taken account of responses is contained in the Draft Environmental Statement Consultation Summary Report (Volume 5: Appendix CT-001/003-000).

2.6 Route section main alternatives

- 2.6.1 The main strategic alternatives to the Proposed Scheme are presented in Volume 1 and in Volume 5: Appendix CT-001-000/1. The main local alternatives considered for the Proposed Scheme within this area are described in this section.
- 2.6.2 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.

Bromford tunnel

- 2.6.3 A key element of the Proposed Scheme running along the Tame Valley in Birmingham is the need for it to cross the M6. This needs to be in the vicinity of Bromford, where the M6 is currently located on an elevated viaduct. The design through the Bromford section of the adjacent Castle Bromwich and Bromford area (CFA25) will be tightly constrained by the existing M6 viaduct, the River Tame (which passes beneath the M6) and existing utility infrastructure (including high voltage overhead power lines and associated pylons and buried pipelines). There is also the existing residential area of Bromford and open space, which is limited in this part of Birmingham. Therefore, as part of the design development process since January 2012, consideration has been given to the design of the Proposed Scheme in this location. The Proposed Scheme will comprise a tunnel in the Bromford area.
- 2.6.4 The following options were considered:
 - the January 2012 announced scheme (an above ground route through Castle Bromwich Business Park and under the elevated M6 through Bromford, requiring extensive works particularly to A452 Chester Road, A4040 Bromford Lane and diversion of the River Tame);

- Option 1A: the January 2012 scheme beneath the M6, with a 'lid' over to allow maintenance of the M6 above;
- Option 1B: the January 2012 scheme within a new combined Hs2 and M6 structure;
- Option 2: the Proposed Scheme (tunnel);
- Option 3B: the Proposed Scheme crossing the M6 earlier, passing south of Castle Bromwich Business Park and running parallel to the M6 through Bromford;
- Option 4: rerouting the M6;
- Option 5: placing the M6 in tunnel with the route of the Proposed Scheme above it;
- Option 6: a bridge carrying the Proposed Scheme over the M6 viaduct; and
- Option 7: using the existing Network Rail infrastructure.

2.6.5 The developed tunnel option made revisions to the January 2012 announced scheme as follows:

- an eastern tunnel portal is proposed approximately 70m west of Langley Drive, Castle Bromwich;
- a western tunnel portal is proposed approximately 150m west of the A4040 Bromford Lane;
- inclines to the tunnel portals will commence approximately 700m east of the A452 Chester Road and approximately 150m east of the existing Stechford and Aston line;
- an eastern access to the Washwood Heath depot will be provided from the western tunnel portal;
- a major diversion of the River Tame along the bored section will not be required;
- major utility diversions will be avoided; and
- substantial highway modifications at the A4040 Bromford Lane and the A452 Chester Road will not be required.

2.6.6 Key environmental considerations for this design element include water and flood risk, landscape impacts associated with loss of open space and significant change to the existing visual landscape, restriction or loss of access to open space, proximity to utility infrastructure, particularly electricity pylons and oil pipeline (including the potential need for relocation of these assets) and community and socio-economic impacts, including the loss of community facilities, impacts on a school (Tame Valley Academy) and on residential areas (particularly Bromford) and impacts on businesses, and traffic related impacts due to the need for extensive highways works.

- 2.6.7 The tunnel option will avoid any works or disruption beneath the M6 viaduct and also there will be no need to divert the River Tame south (from under the M6), with a consequent loss of community facilities, open space and play areas. It will also not require the substantial relocation of the National Grid power lines and pylons for the length of the tunnel. Nor will the proposed tunnel require any major highway works at A452 Chester Road or A4040 Bromford Lane and will therefore have a substantially reduced impact on local businesses and traffic.
- 2.6.8 The Proposed Scheme option of the tunnel is considered to offer the greatest environmental benefits in comparison to the other options because of:
- reduced impacts on community facilities (in Bromford);
 - reduced impacts on public open space (in Bromford);
 - reduced traffic and nuisance impacts associated with major highways and utilities realignments (A452 Chester Road, A4040 Bromford Road, A47 Heartland Parkway, high pressure gas main and overhead power lines);
 - reduced landscape and visual impacts; and
 - reduced operational noise impacts.
- 2.6.9 The tunnel was selected for the Proposed Scheme as in addition to the environmental benefits in the neighbouring area of Castle Bromwich and Bromford (CFA25) it offers significant cost savings particularly by avoiding major road and utility works. This option will, however, generate around 900,000m³ of spoil from the tunnelling. There will still be some demolition of business properties near the tunnel entrance in Castle Bromwich Business Park and at the proposed Washwood Heath depot site which would be similar to the other options.

Washwood Heath depot

- 2.6.10 As part of the design development process since the announcement of the scheme in January 2012, a series of options were considered for the depot layout and main line railway access to make the best use of space and keep land take to a minimum, whilst maximising the operability of the depot. One of the key issues was the position of main line railway access into and out of the depot – the track points (also referred to as switches) need to be on straight, constant level track, to ensure smooth operation and optimum maintenance. There is one location possible for main line access from Curzon Street to the depot with the main line track design, which the Proposed Scheme has selected (see Volume 2: Map CT-06-140, H6 to B7 for the route of the Washwood Heath depot access tracks). This location also enables two reception tracks into the depot which are necessary to accommodate the timetabled arrival of trains. A second access towards the east and the Delta Junction was also included to ensure operational flexibility of the depot. Options were created using both of these possible access points.
- 2.6.11 The Proposed Scheme will utilise the space south of the proposed main line as it leaves the proposed western tunnel portal. The access lines for the depot will extend west to converge with the main line at Duddeston. This layout will result in the loss of

the commercial properties on the site and 12 residential properties on Common Lane (which is fewer than was originally part of the January 2012 announced scheme).

2.6.12 Originally, the following options were considered for the depot:

- Option 1: the January 2012 announced scheme depot layout which had train access through the middle of the site, stabling on the eastern side of the depot, the maintenance shed on the western side and cleaning facilities panning the River Tame passing into Bromford Business Park;
- Option 2: the location of switches on a curve (not pursued as technically undesirable);
- Option B3: train access from the ramp heading into the tunnel portal, avoiding UK Mail at Washwood Heath depot. This option included two tracks to the east of Aston Church Road and the maintenance shed located at the eastern end of the depot;
- Option B4: train access from the ramp heading to the tunnel portal (at the location where UK Mail is currently located);
- Option B5: train access from straight tracks, but impacting the UK Mail site. A development of the January 2012 announced scheme, locating the maintenance shed at the east end of the site on the UK Mail footprint and the servicing sidings at the west end;
- Option B6: as Option B5, with the maintenance shed at the west end of the site. The impact on the west end of the site would be less, though at the cost of occupation of much of the land at that end; and
- Option C7: the Options B3 and B4 layouts would not allow trains to arrive from Curzon Street at line speed. Option C7 would include the reception sidings in the centre of the site to allow line speed run-in and would create single ended servicing sidings at the west end of the site. The maintenance shed would remain at the east end, with reversing sidings being added alongside.

2.6.13 Option C7 was chosen as it will work best operationally.

2.6.14 With the introduction of the tunnel, a second round of optioneering was undertaken to accommodate the western tunnel portal, which resulted in the Proposed Scheme layout. The other options considered were:

- Option 1: the previous layout (Option C7);
- Option 3: the Proposed Scheme has stabling of trains split into two blocks of sidings – one on the west of the site and one on the east of the site, requiring the demolition of UK Mail. The maintenance shed is on the west of the site, south of the stabling sidings;
- Option 3A: similar in layout to option 3, but positioned further to the west in order to avoid the UK Mail site footprint. The head shunt tracks are skewed south of UK Mail; and

- Option 4: this option has all of the stabling sidings together, in parallel with the maintenance shed. It is entirely located west of the current UK Mail footprint. This layout is operationally constrained, due to a large number of train movements using the same switches at the depot throat.

- 2.6.15 The Proposed Scheme (Option 3) was chosen because it will work best operationally.
- 2.6.16 The key environmental issues relate to loss of residential properties on Common Lane, the loss of employment land, potential disturbance to local residents (particularly on Common Lane, Warren Road and Drews Lane) through noise and light for night-time working, the impact on the culverted Washwood Brook and associated floodplain and the effect on local wildlife with disturbance to habitat. It should be noted that all of the options seek to constrain the layout as far north as possible to minimise impacts and also allow management of the brook and flooding.
- 2.6.17 The Proposed Scheme is considered to most appropriately address the environmental considerations in combination with:
- contractors being required to control dust, air pollution, odour and exhaust emissions during construction works;
 - inspecting and monitoring undertaken after consultation with the local authorities to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
 - cleaning (including watering) of haul roads and designated vehicle waiting areas to suppress dust;
 - keeping soil stockpiles away from sensitive receptors (including heritage features), watercourses and surface drains where reasonably practicable, also taking into account the prevailing wind direction relative to sensitive receptors;
 - using enclosures to contain dust emitted from construction activities;
 - undertaking soil spreading, seeding and planting of completed earthworks following completion of earthworks;
 - opening up and diverting Washwood Brook culvert; and
 - accommodating flood mitigation.

Washwood Heath rail overbridge

- 2.6.18 The Washwood Heath rail overbridge is an existing railway viaduct that carries the Stechford and Aston line over the Birmingham and Derby line. The four tracks of the Birmingham and Derby line are crossed by a single span and the remainder of the viaduct comprises brick arches. As part of the design development process since the announcement of the scheme in January 2012, the design of the overbridge has been given further consideration.
- 2.6.19 The selected option will comprise a single span bridge, removing four arches and spanning the route and depot access and egress tracks with a steel beam bridge.

Other options were considered to either use or demolish these existing arches for the Proposed Scheme as there is not sufficient clearance to simply pass beneath. The options considered were:

- Option 1: the Proposed Scheme;
- Option 2: double span, keeping the existing pier. The large size of pier 2 would offer the opportunity to create a support for two separate and simply supported decks. The main advantage compared to Option 1 is the possibility to split the works into two smaller operations, although this would then require two separate railway possessions; and
- Option 3: double span, replacing the existing pier. This would give more flexibility for the Proposed Scheme and Washwood Heath depot access.

2.6.20 The Proposed Scheme (Option 1) design was selected as due to it being the option with least disruption to the existing railway, particularly during construction. The key environmental issue identified was local landscape and visual impact and all three options had similar levels of impact.

Aston Church Road overbridge

2.6.21 The current Aston Church Road bridge does not provide sufficient headroom for the Proposed Scheme to pass under it and the eastern abutment will be in the path of the Washwood Heath depot access railway lines. Therefore, a new Aston Church Road overbridge on a slightly altered alignment is required. As part of the design development process since the January 2012 announced scheme, the design of this new highway bridge has been given further consideration.

2.6.22 The Proposed Scheme will comprise a two-span portal with a single span through girder. One span will be over the existing railway and the other over one over the route.

2.6.23 Two rounds of optioneering were undertaken. The following options were considered in the first round:

- Option 1: offline structure to the west. This would consist of a new road that deviates to the north of the existing road, crosses back over and passes to the south before crossing the route, the existing Birmingham and Derby line and the River Rea Overflow Channel before tying in with the existing A47 Heartlands Parkway/Aston Church Road roundabout;
- Option 2: online replacement, with a road closure; and
- Option 3: the January 2012 announced scheme, but with the replacement bridge to the south of the existing one.

2.6.24 Option 3 was taken forward to the second round because it had the least impact on businesses and a more straightforward design and construction. Key environmental issues were land take, impact on existing vegetation, reduction in floodplain and excavation leading to waste generation.

2.6.25 The following online options were considered in the second round of optioneering:

- Option 1: the Proposed Scheme;
- Option 2: three-span beam and slab. This option would comprise spans over the existing Birmingham and Derby line, the Proposed Scheme main lines and the Washwood Heath depot access lines;
- Option 3A: two-span portals with single span through girder. The portal structures would span the Proposed Scheme and Washwood Heath depot railway and the through girder would span the existing Birmingham and Derby line; and
- Option 3B: two-span portals with single span beam and slab. As Option 3A, but replacing the through girder span with a beam and slab, as in Option 2.

2.6.26 Option 3A was originally selected but was later discounted due to refinements to the route alignment. As a result, Option 1 was selected because of its constructability over the existing railway, allowing adequate headroom for the Proposed Scheme to pass underneath. Key environmental considerations were the visual impacts and impacts upon flood risk management. The Proposed Scheme will have less visual impact than the other options and the design will not increase the flood risk of the surrounding area.

River Rea Overflow Channel realignment

2.6.27 The existing vertical level of the River Rea Overflow Channel (to the south of the A47 Heartlands Parkway and Aston Church Road roundabout – see Volume 2: Map CT-05-140) and the required level of the Proposed Scheme do not allow for a crossing. The overflow channel will, therefore, need to be diverted to the east and parallel to the Proposed Scheme. As part of the design development process since the announcement of the scheme in January 2012, the design of this diversion has been given further consideration.

2.6.28 The Proposed Scheme will comprise separate sewer and watercourse diversions through the A47 Heartlands Parkway/Aston Church Road roundabout. The watercourse diversion will comprise an open channel, wherever possible. Culverts will be necessary when passing beneath roads.

2.6.29 The following options were considered:

- Option 1: the Proposed Scheme;
- Option 2: a river realignment. This option would involve the River Rea Overflow Channel being blocked and diverted to the east of the proposed alignment in an open channel to connect to the proposed Washwood Heath depot drainage system to the north; and
- Option 3: a diversion of the watercourse east of A47 Heartlands Parkway/Aston Church Road roundabout. This option would comprise separate sewer and watercourse diversions. The watercourse would be diverted to the east side of the A47 Heartland Parkway/Aston Church Road roundabout comprising open

channels, wherever possible. Culverts would be necessary when the diversion passes beneath roads.

- 2.6.30 The Proposed Scheme was selected because it will more easily accommodate flood relief and require fewer earthworks.
- 2.6.31 The key environmental issues for selection of the Proposed Scheme design (originally Option 3) were impact on the floodplain, land take and construction impacts. The Proposed Scheme will require fewer earthworks and so less construction impact and will also allow the opportunity to create ecological habitat within the watercourse.

B4114 Saltley viaduct

- 2.6.32 The B4114 Saltley Viaduct currently stretches from a roundabout on the A47 Heartlands Parkway to the west and spans over the River Rea, five existing railway tracks of the Birmingham and Derby line, and the Grand Union Canal, before connecting to High Street/Washwood Heath Road to the east. Replacement of the existing viaduct will be required in order to accommodate the Proposed Scheme's two main lines plus one Washwood Heath depot access line adjacent to the eastern side of the existing railway.
- 2.6.33 The Proposed Scheme will comprise a four span viaduct. There are currently two unused areas to the south of the River Rea that could provide space for alternative pier positions so the viaduct could have five piers and four spans. Two rounds of optioneering were undertaken. The following options were considered in the first round of optioneering:
- Option 1: online; and
 - Option 2: new structure to the north or south of the existing road.
- 2.6.34 Option 1 was taken forward to the second round because it will have the least impact on businesses and an existing electricity pylon. This option will also have the least impact on visual receptors, flood risk and community accessibility.
- 2.6.35 The following options were considered in the second round of optioneering:
- Option 1: six span viaduct. These would be separate, simply supported bridges, skewed to different angles to accommodate the different directions of the tracks, the river and the canal;
 - Option 2: four spans and two embankments. Similar to Option 1, except that spans two and five are replaced by embankments; and
 - Option 3: the Proposed Scheme.
- 2.6.36 The Proposed Scheme design was selected as it will be easier to construct and will cause less disruption to the existing railway, has the least impact on local businesses, particularly during construction and also avoids an electricity transmission tower.
- 2.6.37 The key environmental issues relate to flood risk, cultural heritage and community impacts. The Proposed Scheme will have the least impact with regard to community

disruption, although there was little difference between the options on flood risk and cultural heritage impacts.

Duddeston Junction viaduct

- 2.6.38 The Proposed Scheme needs to cross the Birmingham and Derby line at Duddeston Junction at a highly skewed angle. At this junction, two existing railway lines are separating and there are also entrances to existing depots on both sides of the tracks. There are up to eight tracks that need to be crossed as well as a complicated arrangement of track switches (points) and ongoing train manoeuvres in and out of the depots. In very close proximity to the structure are two key Network Rail buildings: the West Midlands Signal Control Centre and Saltley Power Signal Box. As part of the design development process since the announcement of the scheme in January 2012, the design of this viaduct has been given further consideration.
- 2.6.39 The route of the Proposed Scheme will require tracks to be moved to allow construction of a viaduct. The track move will involve permanently relocating tracks to reduce the constraints of the number of tracks to be crossed and also the constrained and disruptive working to install supports. The viaduct will require short span portals to cross the tracks, with the remainder then supported on columns directly beneath the bridge.
- 2.6.40 The following options were considered:
- Option 1: wide box. The longitudinal supports for the structure would take the form of a series of columns with a deep crosshead, creating a 'tunnel' with open sides;
 - Option 2: twin box. This is a variation of Option 1. The two outer lines of supports would be constructed running parallel to the outside reconfigured existing railway lines;
 - Option 3: viaduct and box. This is a variation of Option 2; the structure would become a viaduct supported on portals once the tracks have climbed high enough to provide sufficient clearance; and
 - Option 4: the Proposed Scheme.
- 2.6.41 The Proposed Scheme design was selected because it will be simpler to construct and requires fewer material resources. The key environmental issues were considered to be visual impact and use of fewer materials. The Proposed Scheme will have a reduced mass and therefore a reduced visual impact.

Curzon Street No.1 viaduct

- 2.6.42 The Proposed Scheme requires a viaduct to carry two tracks over the existing Freightliner Terminal Depot, the River Rea and Erskine Street. The Curzon Street No.1 viaduct is one section of a total 1.8km structure supporting the route. This particular section will sit between the proposed Duddeston Junction viaduct and Curzon Street No.2 viaduct. As part of the design development process since the January 2012 announced scheme the design of this viaduct has been given further consideration.

2.6.43 The Proposed Scheme will comprise a steel composite beams design. The following options were also considered:

- Option 1: precast pre-stressed beams;
- Option 2: the Proposed Scheme; and
- Option 3: concrete box girder.

2.6.44 The Proposed Scheme will have longer spans, so will cause less disruption at ground level. The key environmental issues were visual impact and impacts on the local community. The Proposed Scheme was judged to have a reduced operational impact on an existing business and a slightly reduced visual mass compared to the other options.

Curzon Street No.2 viaduct (crossing the Birmingham and Bushbury line at Vauxhall)

2.6.45 The Proposed Scheme will require a new bridge to carry two new tracks over the three existing tracks, which are on top of the Grade II listed Lawley Street Viaduct. The crossing will be highly skewed and the proposed railway level would need to be elevated approximately 18m above ground level. The new structure will also need to close Viaduct Street and span St James' Place. As part of the design development process since the January 2012 announced scheme, the design of this viaduct has been given further consideration.

2.6.46 The Proposed Scheme will comprise a portal and slab design. The following options were considered:

- Option 1: single span;
- Option 2: box structure; and
- Option 3: the Proposed Scheme.

2.6.47 The Proposed Scheme design was selected as it will be the lightest structure and the quickest and safest to construct.

2.6.48 The key environmental issues were visual impact on the Grade II listed Lawley Street Viaduct and impact on the local community, particularly during construction. The Proposed Scheme will avoid physical connection to the Grade II listed Lawley Street Viaduct and so will not affect its integrity. It will also have a reduced visual impact compared with the other options. Most importantly, it will have a shorter construction time and will therefore have less impact on the local community.

Curzon Street No.3 viaduct

2.6.49 The Proposed Scheme will require a new viaduct to carry the spread of two tracks into seven tracks to allow trains to enter Curzon Street station. This viaduct passes over the A4540 Lawley Middleway dual carriageway and Digbeth Branch Canal. As part of the design development process since the January 2012 announced scheme, the design of this viaduct has been given further consideration.

- 2.6.50 The Proposed Scheme will comprise bifurcated columns¹⁷ with a below-deck arch. This option will encompass a wide deck with voids supported on bifurcated columns. A series of parallel below-deck arches will be used to provide a single span over the canal basin.
- 2.6.51 The following options were considered:
- Option 1: the Proposed Scheme;
 - Option 2: vertical columns. Similar to the Proposed Scheme;
 - Option 3: pre-stressed beams. Also similar to the Proposed Scheme, however the deck construction would use beams supported on crossheads; and
 - Sub Option 4: deep beam/truss over the canal. This option would only be for a different structural form over the canal basin and could be compatible with any of the other options.
- 2.6.52 The key environmental reason that the Proposed Scheme is preferred is that it will have less of a visual impact than Option 3 and will bridge the canal with greater space and will therefore maintain the setting of the canal (which is within a conservation area), the canal tunnel portal (which is Grade II listed) and the canal lock (which is part of a set of heritage features).

¹⁷ A bifurcated column is one that branches into two sections.

3 Agriculture, forestry and soils

3.1 Introduction

- 3.1.1 This section has been scoped out of the assessment as there are no agricultural or forestry activities affected by the Proposed Scheme in this urban area. Impacts on soils are discussed in Section 8, Land quality of this report.

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 (NO₂), fine particulate matter (PM₁₀ and PM_{2.5})¹⁸ and dust.
- 4.1.2 With regard to air quality, the main issues are anticipated to result from the emissions of the above pollutants from construction activities and equipment, road traffic and the operation of combustion plants and dust emissions associated with demolition, site preparation works, construction works and the use of haul routes and road traffic during construction and operation of the Proposed Scheme.
- 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-001-026;
 - Map AQ-01-026; and
 - Maps AQ-02-26-01 and AQ-02-26-02.
- 4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2 CFA26 Map book.

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 Volume 1, the SMR (Volume 5: Appendix CT-001-000/1), the SMR Addendum (Volume 5: Appendix CT-001-000/2) and appendices presented in Volume 5 (AQ-001-026). 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 of traffic during construction and operation or where road alignments have changed.
- 4.2.3 The assessment of impacts arising from construction dust emissions has been undertaken using the methodology based on that produced by the Institute of Air Quality Management (IAQM)¹⁹. 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 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 properties within 20m of dust-generating activities. Thus, a single property very close to a construction site cannot experience a

¹⁸ PM_{2.5} 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 2.5 and 10 micrometres in diameter.

¹⁹ Institute of Air Quality Management, (2011), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance*.

'significant effect' as defined by this methodology. The assessment presented here reaches a conclusion that incorporates this concept of significance being proportional to the number of people affected. However, in cases where less 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 would 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. Concentrations of road traffic-related pollutants are highest along busy roads and diminish when further away from the roads.
- 4.3.2 Estimates for NO₂, PM₁₀ and PM_{2.5} concentrations have been obtained from background concentrations maps produced nationally by the Department for Environment, Food and Rural Affairs (Defra)²⁰.
- 4.3.3 The Washwood Heath to Curzon Street area lies within the Birmingham City Council (BCC) administrative area. Within this area there are six automatic air quality monitoring stations. The most representative for this study area are the two stations located along Tyburn Road, and the one located on Fore Street in Birmingham city centre. In addition, there are 12 diffusion tube sites measuring concentrations of NO₂ in the BCC administrative area; of which one site (Tube 621 located on Lancaster Circus) is considered to be representative of the study area and relevant for this assessment.
- 4.3.4 Data collected by BCC show that most parts of the Washwood Heath to Curzon Street area currently experience annual average concentrations of NO₂ that are above air quality standards, especially in close proximity to major roads, and in Birmingham city centre. Air quality standards for PM_{2.5} and PM₁₀ are met in all parts of the study area. Further details regarding air quality monitoring are shown in Volume 5: Appendix AQ-001-026.

²⁰ Department for Environment, Food and Rural Affairs, (2010), *2010 based background maps for NO_x, NO₂, PM₁₀ and PM_{2.5}*; <http://laqm.defra.gov.uk/maps/maps2010.html>; Accessed July 2013.

- 4.3.5 An Air Quality Management Area (AQMA) has been designated for the entire BCC administrative area by BCC, as a result of NO₂ concentrations being in excess of the annual average air quality standard (40µg/m³) (see Volume 5: Map AQ-01-026).
- 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. In particular, high densities of housing are located within 50m to the south of the land required for construction on Drews Lane, Common Lane and Warren Road. There are no ecological receptors with statutory designations in the study area.

Future baseline

- 4.3.7 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 for the assessment of effects from the construction and operation of the Proposed Scheme.
- 4.3.8 The potential cumulative impact from committed developments on air quality acting in conjunction with the effects from the construction and operation of the Proposed Scheme have been considered as part of this assessment. This has been achieved by including changes in traffic predicted as a result of the committed developments within the traffic data used for the air quality assessments for construction and operation, in which the future air quality baselines are defined as the 'without Proposed Scheme scenarios' at each stage.

Construction (2017)

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

Operation (2026)

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

4.4 Effects arising during construction

Avoidance and mitigation measures

- 4.4.1 Emissions to the atmosphere will be controlled and managed during construction through the mitigation measures set out in the draft CoCP, where appropriate. The draft CoCP includes 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 (LEMPs) which will set out how the project will adapt and deliver the required environmental and community protection measures within each area. This will be achieved 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, 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 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.

4.4.4 An assessment of construction traffic emissions has also been undertaken in the construction period by comparing a without the Proposed Scheme scenario and a with the Proposed Scheme scenario. The traffic data used in the assessment includes the additional traffic from future committed developments.

4.4.5 In the Washwood Heath to Curzon Street area, dust generating activities will occur at construction sites at the location of the proposed Washwood Heath depot and the Bromford tunnel west portal, in the Saltley area, and in Birmingham city centre, at the location of the proposed Curzon Street station. Dust emissions are most likely to be associated with demolition, site preparation works, earthworks, construction of the Washwood Heath depot, cutting of the tunnel portal, Curzon Street No.1 viaduct, Curzon Street No.2 viaduct, Curzon Street No.3 viaduct and Curzon Street station, and the use of haul routes to and from the sites.

4.4.6 Given the mitigation contained within the draft CoCP, the assessment of impacts arising from dust emissions has concluded that they will be slight adverse or negligible in magnitude and that the effect will not be significant. The basis for this conclusion can be found in Volume 5: Appendix AQ-001-026.

4.4.7 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.

- 4.4.8 The assessment of impacts arising from predicted changes to road traffic flows, and the associated emissions, along the local road network has concluded that the magnitude of impact will be imperceptible to small at all of the sensitive receptors considered. This is not considered to be a significant effect. Full details of the assessment can be found in Volume 5: Appendix AQ-001-026.

Permanent effects

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

Cumulative effects

- 4.4.10 This assessment has considered the potential cumulative construction air quality effects of the Proposed Scheme and other committed developments. In this area, there is no development that would be built at the same time as the Proposed Scheme and accordingly, construction air quality effects from the Proposed Scheme is unlikely to result in any significant cumulative effects.
- 4.4.11 The construction dust assessment has considered the potential cumulative air quality effects of the Proposed Scheme and other committed developments. 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

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

Summary of likely significant residual effects

- 4.4.13 The methods outlined within the draft CoCP to control and manage potential air quality effects are considered effective in this location and no significant residual effects are considered likely.

4.5 Effects arising from operation

Avoidance and mitigation measures

- 4.5.1 No mitigation measures are proposed during operation in relation to air quality in this 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 are no direct atmospheric emissions from the operation of trains that will cause an impact on air quality and these have therefore not been assessed. 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 Curzon Street station will not include any combustion plant within its design. As such, there are no air quality impacts relating to energy plant emissions within the Washwood Heath to Curzon Street area.

- 4.5.4 The cleaning of the trains and drainage of toilet facilities, which will take place at the Washwood Heath depot, has also been considered, as the removal of wastewater is a potential source of odour. However, considering that it will be removed from the trains in a controlled manner, detection of odours associated with that activity at the site boundary is unlikely to occur.
- 4.5.5 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. The traffic data includes the additional traffic from future committed developments.
- 4.5.6 The operation of the Proposed Scheme could affect local air quality through additional traffic generated on local roads as a result of vehicles travelling to and from new railway stations and associated infrastructure. The assessment of impacts arising from predicted changes to road traffic emissions along the local road network has established that the magnitude of impact will be imperceptible to small at all receptors considered. The effect on local air quality as a result of the operation of the Proposed Scheme is considered to be not significant. Full details of the assessment can be found in Volume 5: Appendix AQ-001-026.

Cumulative effects

- 4.5.7 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

- 4.5.8 No mitigation measures are proposed in relation to air quality in this area during operation.

Summary of likely significant residual effects

- 4.5.9 No significant residual effects are anticipated for air quality in this area during operation of the Proposed Scheme

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:
- impacts of the loss of land required to construct and operate the Proposed Scheme on a number of regionally significant community resources including the Staffordshire and West Midlands Probation Trust, Birmingham City Council (BCC) Museum Collections Centre, the West Midlands Fire Service Headquarters, and the Arya Samaj Vedic Mission;
 - impacts of loss of public open space in Birmingham city centre including Eastside City Park and Park Street Gardens;
 - isolation impacts on Millennium Point due to road closures and delays and the presence of construction works;
 - impacts on the amenity of education facilities including Leigh Junior, Infant and Nursery School and the Hasanat College;
 - the demolition of residential properties including 12 properties on Common Lane and five student accommodation blocks on Curzon Street; and
 - impacts on the amenity of residents in certain locations.
- 5.1.3 Further details of the community assessments and write-ups of open space surveys and recreational public right of way (PRoW) surveys undertaken within the area are contained in Volume 5: Appendix CM-001-026.
- 5.1.4 Community assessment maps are provided in Volume 5: Maps CM-01-160 to CM-01-163.
- 5.1.5 The current assessment draws on information gathered from local and regional sources including: Leigh Junior, Infant and Nursery School, Birmingham City Council (BCC), BCC Museum and Archive department, West Midlands Fire Service, Arya Samaj Vedic Mission and the Staffordshire and West Midlands Probation Trust.

5.2 Scope, assumptions and limitations

- 5.2.1 The assessment scope, key assumptions and limitations for the community assessment are set out in 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, with the addition of the following locally relevant assumption that due to the large number and relatively high density of cafes, restaurants and public houses in the study area, impacts on these resources are only considered where the nearest alternatives are over 1km away.

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 routing of construction traffic and takes account of catchment areas for community facilities which could be affected where crossed by the route. Overall, the study area is taken as the area of land which encompasses the likely significant effects of the Proposed Scheme.
- 5.3.3 The study area broadly includes those residential areas, within Hodge Hill and Washwood Heath, south of the Birmingham and Derby line and the A47 Heartlands Parkway to the east of the city centre. Whilst the area is predominantly residential, there are significant clusters of traditional industrial areas, which include the former Alstom works site and the former Leyland DAF Vans (LDV) factory site in the north. The local neighbourhoods have their own distinct character, with cultural, religious, educational and community facilities that reflect and serve local needs.
- 5.3.4 The study area continues into the Nechells Ward to the north-east of the city centre, which includes the Eastside quarter of the city, a key regeneration area. The ward includes distinct neighbourhoods at Digbeth, Highgate and Small Heath. There are a range of community facilities at the city and neighbourhood scale, with a cluster of higher education facilities including Birmingham City University.
- 5.3.5 The following provides a more detailed account of the study area and is structured by the individual sections of the Proposed Scheme.

A4040 Bromford Lane to the Stechford and Aston line and the Washwood Heath depot

- 5.3.6 This area includes communities to the west of the Hodge Hill ward. The study area in this location is bound by the Washwood Heath Road to the south, the Stechford and Aston line to the west, Drews Lane to the east, and a large industrial area to the north (comprising the former Alstom works and LDV sites). Residential properties are mostly Victorian terraced housing and post-war semi-detached homes, with infill modern housing as a result of regeneration activity.

Residential properties

- 5.3.7 There are a range of residential properties in terms of tenure, housing size and property condition in this area. The majority of the housing within the study area is Victorian terraced properties and post-war semi-detached homes, with infill modern housing as a result of regeneration activity.

- 5.3.8 The Proposed Scheme is located at the northern extent of the residential neighbourhoods of Washwood Heath. This includes 12 residential properties on Common Lane, which are within an area of land required permanently for the Proposed Scheme. There are an additional 27 residential properties further south on the eastern side of Common Lane, that are outside of the land required for the construction and operation of the Proposed Scheme, but within the study area.
- 5.3.9 At Drews Lane, there is a row of 41 residential properties on the northern side, to the west of the access to the Parkway used car dealership. The gardens to the rear of these properties are at the southern boundary of the former LDV factory site.
- 5.3.10 At Warren Road there are 62 residential properties to the east and west of Leigh Road. The gardens to the rear of these properties are at the southern boundary of the former Alstom works site, and the houses are positioned at an elevated level with views over the site.

Community infrastructure

- 5.3.11 There are a range of community facilities within the Hodge Hill ward, although the only facilities within the study area are the Leigh Junior, Infant and Nursery School, the Hasanat College and the Masjid Ali Mosque.
- 5.3.12 The Leigh Junior, Infant and Nursery School is located at the junction between Warren Road and Leigh Road. The rear of the school, including the outdoor play and recreation areas, border the former Alstom works site to the north. The school is a large inner city state school with 543 pupils aged between three to 11 years.
- 5.3.13 Hasanat College is located adjacent to the Leigh Junior, Infant and Nursery School, and directly south of the former Alstom works site. It includes a two storey traditional building and a large new build extension to the rear, which borders the boundary of the former Alstom works site. The college offers further and higher education and provides an opportunity to study within an Islamic environment with separate classes for males and females.

Stechford and Aston line to Duddeston Mill Road

- 5.3.14 The route in this section will run parallel to the existing Birmingham and Derby line to the west of the Washwood Heath ward. The route will run alongside industrial and office properties at the Saltley Business Park. The study area is bound by the Saltley Business Park to the west, and Washwood Heath Road and Arley Road to the east, with the existing Birmingham and Derby line and Duddeston Mill Road to the north and south. The Alum Rock Road, which provides an established local shopping street, is located off the Saltley Viaduct running eastwards from the Proposed Scheme and is outside of the study area.

Community infrastructure

- 5.3.15 The Masjid Ali Mosque is located on Aston Church Road on the corner with Arley Road within the Saltley area. The mosque provides prayer facilities for approximately 100 people, with separate male and female halls which are used as multi-purpose areas including youth activities. The mosque is used daily with prayer times throughout the day. The mosque provides a mortuary, where the preparation for Janazah burial can

be made. The mosque caters for the local community and also holds large Islamic conferences.

- 5.3.16 The car park and access to the Saltley District Office of the Staffordshire and West Midlands Probation Trust, located on High Street in Saltley, are within an area required for the construction of the Proposed Scheme. The Staffordshire and West Midlands Probation Trust manages offenders in the community and is used seven days a week, with offenders gathering at the site in the morning to attend community payback schemes.

Open space and recreational PRow

- 5.3.17 A section of the Grand Union Canal is located within an area required for the construction of the Proposed Scheme. The section is located to the east of the A47 Heartlands Parkway, beneath and adjacent to B4114 Saltley Viaduct. The Grand Union Canal runs between London and Birmingham and provides a recreational walking and cycling route, passing through the Chiltern Hills, Northamptonshire, Warwickshire and the suburbs of Birmingham.

Duddeston Mill Road to the A4540 Lawley Middleway

- 5.3.18 The study area in this location is bound by the Freightliner Terminal Depot to the south and east and Nechells Parkway and the Lawley Middleway to the west. This includes communities within the Nechells ward. The area is predominately industrial to the east of the Birmingham and Bushbury line, with pockets of residential areas and the West Midlands Fire Service Headquarters off the Vauxhall Road to the west.

Residential properties

- 5.3.19 At the southern end of Northumberland Street and Vauxhall Grove, there is a group of 20 residential properties within four blocks of flats. The properties are nearby to an area of land required for the construction of the Proposed Scheme adjacent to the existing Birmingham and Bushbury line Viaduct.
- 5.3.20 There is a group of 26 residential properties located on Vauxhall Road and the southern extent of Barrack Street and the southern end of Windsor Street South in the Duddeston area, immediately adjacent to land required to construct the Proposed Scheme. The properties are on the edge of a small residential area that is located amongst a range of commercial and industrial uses along Vauxhall Road at the intersection of Vauxhall Road, Curzon Circle and A4540 Lawley Middleway.

Community infrastructure

- 5.3.21 The service yard and access to the rear of the BCC Museum Collections Centre is within an area of land required to construct and operate the Proposed Scheme. The BCC Museum Collections Centre stores artefacts that are used for exhibitions, mostly within Birmingham. It is accessible to the public on open days and for pre-arranged visits, and is also used for specialist training activities.
- 5.3.22 The Arya Samaj Vedic Mission building is principally a place of worship for those of Arya Samaj faith and includes a residential unit. The Arya Samaj Vedic Mission is located on Erskine Street, within the Nechells area, to the east of the city centre. The facility provides weekly activities, classes and meeting space, serving members and

visitors regionally and nationally. The facility is located within an area of land required for the construction and operation of the route.

- 5.3.23 The service yard and viaduct arches to the rear of the West Midlands Fire Service Headquarters building and the off-site car park on St James' Place are within an area required for the construction and operation of the Proposed Scheme. The headquarters operates the fire and rescue service across the West Midlands (County) and Staffordshire, and provides an emergency response from the site. This includes the Fire Control Centre within the main building, which receives all emergency calls, and an ambulance station location with a charging facility within the service yard. The ambulance provides a quick response service to local emergencies. In addition, a fire response (vehicle and equipment) is dispatched from this site if additional capacity is required to that provided by a local fire station during an emergency.

Open space and recreational PRow

- 5.3.24 Garrison Lane Park is located to the east of the Garrison Circus roundabout and is accessed off Witton Street. The park provides a children's play area, an informal football pitch and grassland and is approximately 21,165m² in total area. The park is lined with trees along Garrison Lane and Lower Dartmouth Street. An area of the park is within land required for the construction of the Proposed Scheme.

End of Washwood Heath to Curzon Street CFA: Curzon Street station

- 5.3.25 The study area at this location comprises the Eastside and Digbeth areas of Birmingham City Centre. The area is bound by the Birmingham to Didcote line to the south, Jennens Road to the north and Moor Street Queensway and the Lawley Middleway to the east and west. Residential areas are located within the Digbeth area with warehouse conversion apartments and Victorian terraced housing. Within the Eastside area there are several education buildings including the Birmingham City University Campus and Matthew Bolton College with several student accommodation facilities nearby. Other key features include Eastside City Park and Millennium Point.

Residential properties

- 5.3.26 Within the area surrounding Curzon Street, there are a range of further education facilities, resulting in high numbers of young adults and student accommodation. This includes the Curzon Gateway student accommodation, made up of five accommodation blocks that provide a total of 752 student flats, which is an area required for the construction and operation of the route.
- 5.3.27 Jennens Court, located on Jennens Road, is a private student accommodation block associated with Birmingham City University that provides accommodation for a total of 350 students and is within the study area.
- 5.3.28 There is a row of 11 three to four storey Victorian terraced properties located on Bordesley Street in Digbeth, approximately 200m south-east of Birmingham Moor Street station, which are within the study area. Three of the properties at the end of the row sit above shops and cafes. The residential properties are an exception to what is a predominantly industrial area.

- 5.3.29 Masshouse Hive includes two large, modern residential tower blocks (Block I and Block M) located within the large traffic island created by Moor Street Queensway, Masshouse Lane and Park Street. Together, the high-rise residential blocks house 340 apartments over 14 storeys. The blocks are located approximately 150m west of Millennium Point, 300m east of Birmingham Moor Street and are within the study area.

Community infrastructure

- 5.3.30 The Parkside Building, forms part of the Birmingham City University City Centre Campus alongside Millennium Point to the west. The Parkside Building accommodates the University's School of Media and the Institute of Art and Design. This is a five floor building providing studio and workshop space, which fronts Curzon Street and Eastside City Park.
- 5.3.31 Millennium Point, located on Curzon Street, includes visitor attractions such as the Think Tank Museum and a cinema, educational establishments including Birmingham City University and Birmingham Metropolitan College, as well as commercial business and retail units. The Millennium Point building fronts onto Eastside City Park with vehicular access off Jennens Road, Curzon Street and Belmont Road. Pedestrian access is via Park Street, Fazeley Street, New Canal Street, Curzon Street to the south, and off Jennens Road to the north. The Think Tank Museum includes the Think Tank Science Garden, to the front of Millennium Point, which was developed as part of Eastside City Park. Millennium Point is adjacent to land required for the construction and operation of the Proposed Scheme.
- 5.3.32 The Birmingham Polish Centre is located on Bordesley Street, immediately south of the Birmingham to Derby line, with a car park to the rear. The centre is regularly used by the local Polish community, as a place to practice Polish traditions, language and culture. Members of the Polish Centre attend services at St Michael's Catholic Church, located on Moor Street Queensway, on a weekly basis. It is also used by the wider community, with regular events, a bar and a delicatessen. The centre provides three function rooms that together accommodate approximately 220 people.

Open space and recreational PRow

- 5.3.33 Park Street Gardens provides an urban park of approximately 6,600m² and is located off Park Street and Albert Street. It is principally used by city centre workers, local students and visitors to the city on leisure trips whilst accessing the nearby Hotel La Tour, shopping centre and Millennium Point. The park has an important heritage value, with records evidencing the use of the park as a cemetery linked to St Martin's Church through the 1800's, and grave stones evident within parts of the gardens. The park includes a seating area and footpaths, providing access from Park Street to the Eastside quarter of the city.
- 5.3.34 Eastside City Park provides approximately 32,000m² of public open space, which extends from Cardigan Street, lines the frontage of Millennium Point and links to Park Street Gardens. The park provides formal landscaped gardens, a children's play area, a

science garden fronting Millennium Point, public squares, and grassed areas of open space. The park is a key feature in the regeneration of Eastside, as set out in the Eastside Masterplan²¹. The park is well used, particularly with students at the nearby university, families visiting Millennium Point, residents and shoppers from the city centre²².

- 5.3.35 The Digbeth Branch Canal runs through this area, providing a local recreational pedestrian route along the canal's towpath. A section of the canal, between Proof House Junction and Curzon Street, is located within the area required for the construction of the Proposed Scheme.

Future baseline

Construction (2017)

- 5.3.36 Volume 5: Appendix CT-004-000/1 provides details of the developments which are assumed to have been implemented by 2017. Committed developments within this area that will materially alter the baseline conditions in 2017 for the community are listed below:

- a mixed use development 'student hub' including formal teaching areas as part of the Birmingham City University Campus at land bounded by Gopsal Street, Cardigan Street, Curzon Street and Digbeth Branch Canal within the Eastside area of the city (2012/04578/PA);
- a mixed use development including residential with 353 flats at Bordesley Street, Typhoo Wharf in Digbeth (2007/01816/PA);
- a mixed use development comprising four buildings at Masshouse (Plot 7) on land bounded by Dale End, Chapel Street, Moor Street Queensway and Priory Queensway (2007/01816/PA);
- the conversion of a retail unit to five dwellings as Masshouse Plaza (2013/01181/PA); and
- the redevelopment of Eastside Locks comprising mixed use development including 475 residential units (2008/02942/PA).

Operation (2026)

- 5.3.37 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.

²¹ Birmingham City Council, (2011), *Eastside Masterplan, Curzon Street, Birmingham Big City Plan*.

²² See the Eastside City Park Open Space survey write up in Volume 5: Appendix CM-001-026.

5.4 Effects arising during construction

Avoidance and mitigation measures

- 5.4.1 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:
- the route from Duddeston Mill Road to the proposed Curzon Street station is elevated on the Duddeston Junction viaduct and Curzon Street viaducts No.1, No.2 and No.3, which will reduce isolation of residential properties from community infrastructure on the other side of the route of the Proposed Scheme, by maintaining access routes beneath the viaduct;
 - the construction traffic routes to the Washwood Heath depot will avoid residential areas to the south including Warren Road, Common Lane, Drews Lane and Leigh Road;
 - access routes which are crossed by the route of the Proposed Scheme will be maintained in the long-term where feasible, including roads, footpaths, cycle routes, pedestrian walkways and towpaths. Disturbance during the construction period will be reduced by alternative temporary routes for Aston Church Road, B4114 Saltley Viaduct, Duddeston Mill Road and the A4540 Lawley Middleway during their temporary closures; and
 - provisions to ensure that access is maintained to Millennium Point, Birmingham Gun Barrel Proof House, Masjid Ali Mosque, Net Adventure Cyber Café, the Polish Centre, Taboo Cinema and The White Tower public house throughout the construction period.
- 5.4.2 The draft CoCP includes a range of provisions that will help mitigate community effects associated with construction within this area, including the following (see Volume 5: Appendix CT-003-000):
- appointment of community relations personnel (draft CoCP, Section 5);
 - community helpline to handle enquires from the public (draft CoCP, Section 5);
 - sensitive layout of construction sites to minimise nuisance (draft CoCP, Section 5);
 - where reasonably practicable, maintenance of PRow for pedestrians and cyclists around the perimeter of construction sites 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 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 reasonably practicable, the avoidance of large good 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-001-026. Each assessment form presents information that explains the rationale for determining the rating for sensitivity of the affected community resource, magnitude of impact and the assessment of significance.

A4040 Bromford Lane to Stechford and Aston line and the Washwood Heath depot

Temporary effects

Residential properties

- 5.4.4 The boundary of construction works associated with the proposed Washwood Heath depot will run adjacent to the rear of approximately 27 residential properties on the eastern side of Common Lane. The construction boundary will be marked with temporary fencing approximately 3.6m high. The area to the immediate rear of the properties will be a temporary materials processing and logistics centre, which will be linked to the Bromford tunnel west portal (central) satellite compound.
- 5.4.5 Construction works will involve the demolition of several buildings and structures at the former Alstom works site, utility diversions, bulk earthworks and remediation, the reprocessing of materials and the construction of the depot buildings and track works. These works will result in significant daytime noise effects. Piling activities at the tunnel portal will result in significant night-time noise effects on the properties at the northern end of Common Lane. In addition, significant visual effects will occur from the upper storeys at the rear of the properties. The view will be dominated by the temporary materials processing and logistics centre and the satellite compound.
- 5.4.6 The combination of significant visual and noise effects will result in a major adverse effect on the amenity of the residents on Common Lane for approximately two years in total, and is therefore considered significant.
- 5.4.7 A group of approximately 41 residential properties along the northern edge of Drews Lane are located adjacent to the boundary of land required for the construction of the proposed Washwood Heath depot. The gardens to the rear of the properties will be bound by temporary hoarding approximately 3.6m high. Construction works to the rear of the properties will include the Bromford tunnel west portal (east) main compound, the demolition of the UK Mail building and the diversion of the Washwood Heath Brook and the erection of new depot buildings. In addition, the temporary material processing and logistics centre will be located to the west of the properties. These works will result in significant noise effects during the daytime. In addition, adverse visual effects are expected to the rear of the properties, due to the demolition of the UK Mail building, the introduction of site hoardings and construction plant, including tunnel boring machinery for the construction of the proposed Bromford tunnel. The combination of significant noise and visual effects will result in a major

adverse effect on the amenity of residents on Drews Lane for up to two years in total, and is therefore considered significant.

- 5.4.8 Approximately 62 residential properties (east and west of the junction with Leigh Road) on the northern side of Warren Road will be immediately adjacent to the boundary of land required for the construction of the proposed Washwood Heath depot. The gardens to the rear of the properties will be bound by temporary hoarding approximately 3.6m high. Construction works to the rear of the properties will include the demolition of several buildings and structures at the former Alstom works site. Residents at these properties will experience significant noise effects during the daytime due to a range of construction activities including demolitions at the rear of the properties. Residents at the western extent of Warren Road will also experience significant night-time effects due to piling. In addition these residents will experience significant visual effects from the rear of the properties, particularly from the upper stories, with construction activities located approximately 80m away at the closest point. Views of the construction activities will be further exposed due to the demolition of the existing industrial buildings to the immediate north of the properties. The combination of noise and visual effects will result in a moderate adverse effect on the amenity of the residents at Warren Road for up to three months in total, and is therefore considered significant.

Community infrastructure

- 5.4.9 The Leigh Junior, Infant and Nursery School is located directly south of the land required for the construction of the Washwood Heath depot. This land will be bound by construction hoarding approximately 4.8m high to provide screening to the school. The school is adjacent to several buildings and structures between A47 Heartlands Parkway and Aston Church Road, associated with the disused railway rolling stock works at the former Alstom works site, which will be demolished. The demolition works along with a range of other construction works will result in significant noise effects during the daytime. In addition, pupils and staff will be exposed to significant adverse visual effects, with views of the construction works. The combination of noise and visual effects will result in a major adverse effect on the amenity of the pupils and staff at the school for approximately four years and six months in total, and is therefore considered significant. HS2 Ltd will work closely with Leigh Junior, Infant and Nursery School to identify reasonably practicable measures to mitigate the residual significant amenity effect, including discretionary measures identified in the draft CoCP.
- 5.4.10 The Hasanat College will be located directly south of the land required for the construction of the Washwood Heath depot. This land will be bound by construction hoarding approximately 4.8m high to provide screening to the school. The college is adjacent to several buildings and structures between A47 Heartlands Parkway and Aston Church Road, associated with the disused railway rolling stock works at the former Alstom works site, which will be demolished. These demolition works in addition to the erection of the hoarding as well as other construction works will result in significant noise effects during the daytime. In addition, pupils and staff at the school will be exposed to significant visual effects, with views across the construction works. The combination of noise and visual effects will result in a major adverse effect

on the amenity of pupils and staff at the school for approximately four years in total, and is therefore considered significant. HS2 Ltd will work closely with Hasanat College to identify reasonably practicable measures to mitigate the residual significant amenity effect, including discretionary measures identified in the draft CoCP.

Permanent effects

Residential properties

- 5.4.11 Twelve residential properties on Common Lane (property numbers 127 to 149) will be demolished as part of the construction of the proposed Washwood Heath depot. The land is required permanently for the Washwood Heath Brook diversion, a balancing pond and landscape mitigation planting to the south of the depot. The permanent loss of these residential properties is a major adverse effect and is therefore considered significant.

Cumulative effects

- 5.4.12 From a community wide perspective, the above assessment has concluded that there will be several adverse significant effects including; the demolition of 12 properties on Common Lane, effects on the amenity of residents at Common Lane, Warren Road and Drews Lane and effects on the amenity of pupils and staff at Leigh Junior, Infant and Nursery School and Hasanat College. In addition the amenity of the nearby Masjid Ali Mosque on Aston Church Road will also be affected (see section Stechford and Aston Line to Duddeston Mill Road). These effects are concentrated on the communities to the west of the Hodge Hill ward, on the northern boundary of the Washwood Heath ward, defined by the Stechford and Aston line to the west, Drews Lane to the east and the former Alstom works and LDV factory sites to the north. The effects are all associated with the construction of the Washwood Heath depot and wider elements of the Proposed Scheme including the Bromford tunnel.
- 5.4.13 Given the effects on a large number of residential properties and effects on a school, a college and a mosque which are used by residents within the wider area, it is considered that the effects in question will affect a significant proportion of people in the community. It is therefore considered there will be a community wide effect in this area.

Stechford and Aston line to Duddeston Mill Road

Temporary effects

Community infrastructure

- 5.4.14 The Masjid Ali Mosque is on the corner of Aston Church Road with Arley Road, which will provide construction traffic routes, along with Washwood Heath Road and Adderley Road. Heavy good vehicles (HGVs) will use these roads on a frequent basis, passing the front and side entrance to the mosque. Construction activities will be associated with the demolition and replacement of the existing Aston Church Road overbridge, to the west of the mosque. This will involve utility diversion works nearby the mosque. The replacement Aston Church Road overbridge will be a three-span structure, crossing the existing Birmingham and Derby line, the route and the proposed Washwood Heath depot access lines. These works will result in significant noise effects during the daytime, in particular due to the proximity of required utility

diversions. The combination of significant noise and HGV traffic effects will result in a major adverse effect on the amenity of users of the mosque for approximately five months in total, and is therefore considered significant.

- 5.4.15 As the route passes beneath B4114 Saltley Viaduct, it will also cross the Grand Union Canal. A small section of the Grand Union Canal, approximately 380m length, is located within an area required for the construction of the Saltley canal underbridge. Access restrictions to the canal waterway will apply for short periods during construction while deck beams are lifted into place as part of the construction of the Saltley canal underbridge. This will include either six weekend or 30 overnight closures of the canal waterway and towpath. A local temporary alternative route for pedestrians during the temporary closure of the towpath, adjacent to the canal, will be put in place. It is predicted that this will be a negligible effect, and is therefore not considered to be significant.
- 5.4.16 The Proposed Scheme will require the vertical realignment of High Street and Pennine Way in Saltley (to the east of B4114 Saltley Viaduct). A retaining wall is required to be constructed between the Staffordshire and West Midlands Probation Trust site and the B4114 Saltley Viaduct road. The access point to the Staffordshire and West Midlands Probation Trust will be required for the construction and operation of the Proposed Scheme (see Permanent effects). In addition, an area within the front car park of the Staffordshire and West Midlands Probation Trust, approximately 300m², will be required temporarily for the construction of the retaining wall. These works will be phased, so that access and some parking can be maintained throughout the construction period. As such, this will be a minor adverse effect, and is therefore not considered significant.

Permanent effects

Community infrastructure

- 5.4.17 The Proposed Scheme will require the vertical realignment of High Street and Pennine Way in Saltley (to the east of B4114 Saltley Viaduct). The realignment of these roads will result in the permanent loss of the existing access point to the Staffordshire and West Midlands Probation Trust, off Pennine Way, due to an insurmountable difference in levels. This is the only existing access point to the Staffordshire and West Midlands Probation Trust site. The Proposed Scheme includes the provision of a permanent replacement access road off Gate Street to the east into the site. The replacement access road will provide access within the construction period of the Proposed Scheme. This will be a minor adverse effect, and is not considered significant.

Cumulative effects

- 5.4.18 No cumulative or community wide effects on community resources have been identified in this section.

Duddeston Mill Road to the A4540 Lawley Middleway

Temporary effects

Residential properties

- 5.4.19 A group of approximately 20 residential properties located at the southern end of Northumberland Street and Vauxhall Grove will be located in close proximity to the boundary of land required to construct the Proposed Scheme. This will include the construction of the Curzon Street No.2 viaduct across the Birmingham and Bushbury line to the south-west of the properties, with access gained via the service yard of the West Midlands Fire Service Headquarters. In addition, works will include the demolition of buildings to the south of the Birmingham and Bushbury line within the Freightliner Terminal Depot. These works will result in significant noise effects during the daytime. In addition residents will experience significant noise effects during the night-time due to the construction of the viaduct deck. Significant visual effects are expected from the upper stories of the block of flats fronting Vauxhall Grove and the block of flats on Northumberland Street. This will include un-obscured views of the 2.4m high fencing that will surround the construction working area, the proposed vehicle turning head at the southern end of the Northumberland Street and temporary lighting associated with the construction of the Curzon Street No.2 viaduct during the night-time. The combination of significant noise and visual effects will result in a major adverse effect on the amenity of residents at these properties for approximately nine months during the daytime and five months at night-time, and is therefore considered significant.
- 5.4.20 A group of approximately 26 residential properties fronting Vauxhall Road at the junction with Barrack Street and on Windsor Street South including a residential unit above the White Tower public house will be adjacent to construction works, and construction traffic routes including Vauxhall Road and A4540 Lawley Middleway. This will include the construction of the Curzon Street No.3 viaduct, the demolition of buildings behind St James' House on Vauxhall Road, the demolition of the Curzon Gateway student accommodation, the removal of the Curzon Circle roundabout on A4540 Lawley Middleway and the construction of a new four way junction. Road works will result in significant noise effects during the daytime (at properties closest to the A4540 Lawley Middleway) and the installation of the viaduct deck will result in significant night-time noise effects. In addition, significant visual effects of the construction works are expected. The combination of significant noise and visual effects will result in a major adverse effect on the amenity of residents at these properties for approximately up to seven months in total, and is therefore considered significant.

Community infrastructure

- 5.4.21 The route on viaduct (Curzon Street No.1 viaduct) will pass through the south-west corner of the service yard to the rear of the BCC Museum Collections Centre (see permanent effects for details of permanent loss of land). In addition, the whole of the service yard and access road will be required to accommodate associated construction works, for approximately four years. The service yard to the rear of the BCC Museum Collections Centre is used for the loading and transportation of large exhibits on an occasional basis. The BCC Museum Collections Centre could continue to operate the

services it provides to visitors including organised tours and training. However, the transportation of exhibits will be restricted. This will be a minor adverse effect, and is therefore not considered to be significant.

- 5.4.22 The route on viaduct (Curzon Street No.2 viaduct) will pass through the service yard to the rear of the West Midlands Fire Service Headquarters building and also through the adjacent off-site staff car park (Curzon Street No.3 viaduct). This will result in the loss of access to the service yard, including the undercroft parking area, and the adjacent offsite car park for approximately five years during the construction period. Construction works will include; the erection of temporary fencing approximately 2.4m high around the area of works, a temporary construction haul road to the south of the service yard and car park and the demolition of the existing decked car park structure at the off-site car park. The service yard and off-site car park provide staff parking, including parking for staff operating the Fire Control Centre. Nearby parking is required for these staff due to 24 hour shift working. There are currently no alternative car parks available nearby. The construction works will also require the removal of: the existing ambulance dispatch point, access to the viaduct arches and other existing infrastructure such as the water tanks. This will impair the function of the West Midland Fire Service Headquarters, and is therefore a major adverse effect that is considered significant.

Open space and recreational PRow

- 5.4.23 The construction of the Proposed Scheme will require approximately 880m² of land within the eastern extent of the Garrison Lane Park (4% of the total park). The land is required for highway works including the conversion of Garrison Circus from a roundabout to a traffic light controlled junction. It is not considered that these works will affect the function of the park. This will therefore be a minor adverse effect, and is not considered significant.

Permanent effects

Community infrastructure

- 5.4.24 Land to the south-west corner of the service yard to the rear of the BCC Museum Collections Centre will be required permanently for the Curzon Street No.1 viaduct. This will include approximately 100m² of the service yard and is not considered to impact on the functioning of the facility following the construction of the Proposed Scheme. This will be a negligible adverse effect, and is therefore not considered significant.
- 5.4.25 The Arya Samaj Vedic Mission building and outside areas are within land required permanently for the Proposed Scheme and the use of the site will be lost permanently. The building will be demolished as part of the construction of the Curzon Street No.1 viaduct, which will run through the site. The Arya Samaj Vedic Mission building is a well-used and valued resource. There is, at present, no alternative place of worship of this kind in the region. The loss of the facility will be a major adverse effect and is considered to be significant.
- 5.4.26 The Proposed Scheme will require land permanently within the West Midlands Fire Service Headquarters site for the location of the Curzon Street No.2 viaduct.

The viaduct will be located approximately 10m from the rear of the building and will be approximately 20m high. The land required permanently includes approximately 1,000m² of the service yard and will not prevent access to the undercroft parking area. In addition there will be a permanent loss of approximately 500m² of the off-site car park, for the location of the Curzon Street No.3 viaduct. The remainder of the service yard and off site car park, which is not required permanently, will be reinstated following the construction works. This will include the reinstatement of parking provisions and the reconfiguration of the service yard to enable the replacement of the service yard facilities, infrastructure and access. However, access to the four viaduct arches that are used for storage and other activities by the West Midlands Fire Service will be lost permanently. This will be a minor adverse effect and is not considered significant.

Cumulative effects

- 5.4.27 No cumulative or community wide effects on community resources have been identified in this section.

End of Washwood Heath to Curzon Street CFA: Curzon Street station

Temporary effects

Residential properties

- 5.4.28 A group of approximately 11 residential properties at the northern end of Bordesley Street will be located adjacent to construction traffic routes associated with the proposed Curzon Street station to the north. The construction of the station will cause significant noise effects, in particular due to utility diversions. There will also be significant adverse views of the construction works. In particular cranes and other high level activities associated with the construction of the southern elevation and roof of the proposed Curzon Street station will be visible above the intervening buildings and the Rugby to Birmingham line. Properties that face up New Bartholomew Street and the four storey properties at the southern end of the row will experience more direct views. In addition, a construction traffic route is proposed on Bordesley Street, with a significant increase in HGVs passing the front of the properties. The combination of noise, visual and HGV traffic effects will result in a major adverse effect on the amenity of residents at these properties for approximately five years in total, and is therefore considered significant.
- 5.4.29 Planning consent has been granted and it is assumed that Typhoo Wharf, including 353 residential units, will be complete and in use at the commencement of the construction of the Proposed Scheme. Typhoo Wharf will be located approximately 115m south of the proposed Curzon Street station on Bordesley Street. Construction works associated with the station are predicted to result in significant visual effects. This will include high level construction activities associated with the proposed Curzon Street station and the associated traffic on Fazeley Street and New Canal Street, which will be visible in the middle ground. New Canal Street will provide a construction traffic route, which will result in a significant increase in the number of HGV, which may result in disturbance to residents. The combination of visual and HGV traffic effects will result in a major adverse effect on the amenity of residents at these

properties for approximately five years in total, and is therefore considered significant.

- 5.4.30 Jennens Court, a private student accommodation block on Etna Street, with approximately 350 students will be located north of the proposed Curzon Street station. It is predicted that residents at Jennens Court will experience significant noise effects during the daytime, mainly associated with demolitions and the construction of the Curzon Street station including utility works. In addition, significant visual effects from Jennens Court are expected due to direct views of construction activities associated with the proposed Curzon Street station and the Curzon Street No.3 viaduct. This will include the construction working area on the north side of the station, the Curzon Street station main compound and Curzon Street No.3 viaduct satellite compound. The combination of visual and noise effects will result in a major adverse effect on the amenity of residents at Jennens Court for approximately one year and eight months, and is therefore considered significant.
- 5.4.31 Planning consent has been granted and it is assumed that the Eastside Locks mixed use development, including 475 residential units, will be complete and in use at the commencement of the construction of the Proposed Scheme. Curzon Street station and the Curzon Street No.3 viaduct will be located to the south of the development area, along with the associated construction compounds. Construction works will result in significant noise effects during the daytime and night-time. In addition, residents will experience significant visual effects on fore and middle ground views of the construction works, including the demolition of the Curzon Gateway student accommodation blocks. The combination of visual and noise effects will result in a major adverse effect on the amenity of residents at Eastside Locks for approximately one year in total, and is therefore considered significant.
- 5.4.32 The 340 residential flats at Masshouse Hive fronting Park Street are located immediately adjacent to the boundary of construction works associated with the proposed Curzon Street station. The property is located on three construction traffic routes including Park Street, Masshouse Lane and Moor Street Queensway, which will result in a significant increase in HGV traffic. Adverse significant visual effects will include direct and close views associated within the construction of Curzon Street station and the construction compounds. The construction activities will be approximately 15m from the viewpoint, and will obscure the views of the existing railway viaduct and the Warwick Bar Conservation Area. Additionally, the loss of mature trees at Park Street Gardens will open up views during the construction phase. The combination of visual and HGV traffic effects will result in a major adverse effect on the amenity of residents at Masshouse Hive for approximately five years, and is therefore considered significant.
- 5.4.33 Planning consent has been granted for the completion of the Masshouse mixed use complex. This includes the development of a larger mixed use development at Plot 7, including 12,355m² of residential development. The development will include four blocks, with Block C providing the residential accommodation, fronting onto Moor Street Queensway. Planning permission has also been granted for the conversion of retail space on the ground floor of Masshouse Hive to five residential units. It is predicted that the residents at these properties will experience similar significant

visual and HGV traffic effects as those reported in regard to the existing Masshouse Hive properties. The combination of visual and transport effects will result in two major adverse effects, on the amenity of residents at Block C and those on the ground floor for approximately five years, and are both therefore considered significant.

Community infrastructure

- 5.4.34 The Parkside Building and the proposed 'student hub' committed development, both of which form part of Birmingham City University City Centre Campus, will be located directly north of the construction works associated with the proposed Curzon Street station and the Curzon Street No.3 viaduct. This will include the Curzon Street No.3 viaduct satellite compound and the Curzon Street station main construction compound. Curzon Street will provide a construction traffic route, which will result in a significant increase in HGVs passing the Parkside Building and the formal teaching areas within the 'student hub' development. Construction works will be visible in the foreground and middle ground, from the teaching facilities. The temporary fencing that will surround the working area along Curzon Street, the construction site access point near the Digbeth Branch Canal and the demolition of the Curzon Gateway student accommodation will also be visible. Adverse views will result in a significant visual effect on those using the teaching facilities. In addition, the construction works will result in significant noise effects during the daytime. A combination of significant noise, HGV traffic and visual effects will result in two separate major adverse effects on the students, staff and visitors at the Parkside Building and those using the 'student hub' for approximately five years and is therefore considered significant.
- 5.4.35 Millennium Point is located directly to the north of the construction boundary of the proposed Curzon Street station. The construction site for the Curzon Street station includes an area of land between Curzon Street, the Birmingham and Derby line, A4540 Lawley Middleway and Moor Street Queensway. The land will be used for the location of the Curzon Street station main compound to the rear of the former Curzon Street Station building and a construction haul road. The land will be bound by temporary hoarding over 2.4m high. These works will cause a visual barrier between Millennium Point and the areas to the south and south-west.
- 5.4.36 The Proposed Scheme will require the permanent closure of several roads including; Park Street (between Masshouse Lane and Bordesley Street), Fazeley Street (north of the Rugby to Birmingham line), Banbury Street (from its junction with New Canal Street to the Rugby to Birmingham line), Andover Street (from the junction with Banbury Street and the Rugby and Birmingham line), Seymour Street, Paternoster Row and the long term closure (approximately five years) of the northern end of New Canal Street. Pedestrian routes including Fazeley Street and Park Street are very well used (see Transport, Section 12). This will impact on vehicular and pedestrian access from the areas to the south of Millennium Point.
- 5.4.37 Pedestrians accessing Millennium Point from areas to the west will be required to walk alongside the temporary hoarding off Moor Street Queensway and Curzon Street. Pedestrians accessing Millennium Point from the south will be required to follow a temporary diversion to the east of New Canal Street, along a proposed construction haul road (whilst not in use) or along the permanent realigned New Canal Street, depending on the stage of the construction works. Following the construction period,

the Proposed Scheme will include permanent provisions for pedestrian access, along New Canal Street, and enhanced connectivity (see Cumulative effects). During construction, vehicle users accessing the rear car park of Millennium Point will experience delays on Jennens Road. Delays will also be experienced on Moor Street Queensway and Curzon Street. In addition, the Proposed Scheme will require the permanent removal of the temporary car park to the south of Millennium Point.

- 5.4.38 The combination of the adjacent construction works and closures and delays to the surrounding road network will result in reduced accessibility to Millennium Point. In particular, this will impact on pedestrians travelling to Millennium Point from areas to the south and west, including Digbeth, Moor Street station and the Bullring. The presence of visual barriers and reduced accessibility during construction will result in a major adverse isolation effect for approximately five years, and is therefore considered significant.
- 5.4.39 The Think Tank Museum is located within Millennium Point and includes a science garden located directly in front of the Millennium Point building. The southern boundary of the garden will be adjacent to the construction works, including the use of Curzon Street as a construction traffic route, the Curzon Street station main compound and Curzon Street No.3 viaduct satellite compound further south. Nearby construction works will result in significant adverse visual effects. These effects relate to ground engineering works and the use of tower cranes for the lifting and placing of precast concrete units. In addition, there will be a significant number of HGVs passing the science garden, on Curzon Street. The combination of visual and HGV traffic effects will affect the character and enjoyment of the science garden as a recreational resource for approximately five years. This will be a major adverse effect on the amenity of the users of the Think Tank Science Garden, and is therefore considered significant.
- 5.4.40 The Polish Centre will be located south of the proposed Curzon Street station and adjacent to associated utility works and construction traffic routes. These works will result in a significant adverse noise effect. In addition, Bordesley Street and Park Street will provide construction traffic routes that will result in a significant increase in HGV traffic. The combination of significant noise and HGV traffic effects will result in a major adverse effect on the amenity of the users of the Polish Centre for approximately one year in total, and is therefore considered significant.
- 5.4.41 The Polish Centre will be impacted by reduced access from Park Street during the construction period. The Proposed Scheme will provide a turning circle to allow vehicles to access the centre and depart back onto Park Street. Pedestrian access to St Michael's Church will be restricted during the construction period due to the permanent closure of Freeman Street, a section of Park Street and Seymour Street. Pedestrians travelling from the Polish Centre to the church will be able to access the church via the southern section of Park Street, Moor Street and Moor Street Queensway. This will increase the distance of the pedestrian route and may cause inconvenience for approximately five years during the construction period. The Proposed Scheme will provide a pedestrian link from Bordesley Street and Park Street, at the south side of the proposed Curzon Street station, above the Rugby to Birmingham line, to the proposed station square fronting Moor Street Queensway.

This could be used to access Moor Street Queensway. The reduced pedestrian accessibility from the Polish Centre to the nearby church will be a minor adverse isolation effect, and is therefore not considered significant.

Open space and recreational PRow

- 5.4.42 A short section of the Digbeth Branch Canal will be affected by the Proposed Scheme as the route on Curzon Street No.3 viaduct splits from two to seven railway lines on approach to Curzon Street station. Restrictions to the access to the canal towpaths will apply throughout the construction of the viaduct. This will include either six weekend or 30 overnight closures of the canal waterway and towpath. A temporary alternative route for pedestrians during the temporary closure of the towpath, adjacent to the canal, will be put in place. The diversion will mean that this effect will be negligible and it not considered significant.
- 5.4.43 Within Eastside City Park, a public square area and a grassed area south of the square will be required for the construction and operation of the Proposed Scheme. This includes approximately 11,500m² of the park (36% of the total park), which will be removed for an estimated five years during the construction period. The land will be used for the construction of Curzon Street station, including a number of utility diversions, and will be bound by a temporary fence of 2.4m high. Part of this land (approximately 3,000m²) will be required for the construction period only, following which it will be reinstated as Eastside City Park. The remaining 8,500m² required by the Proposed Scheme, will be removed permanently (see permanent effects). The temporary but long-term loss of the public square and nearby grass areas will impair the overall function of the park, particularly as the area provides a pedestrian link to the city centre. This will be a major adverse effect and is therefore considered to be significant.
- 5.4.44 The construction works within Eastside City Park will result in significant visual effects on the users of the remainder of the park. In addition, Curzon Street will provide a construction traffic route which will result in a significant increase in the number of HGVs passing the park. The combination of significant visual and HGV traffic effects, for approximately six years, will impact on the existing character and enjoyment the park provides as a recreational resource. This will be a major adverse effect, and is considered significant.

Permanent effects

Residential properties

- 5.4.45 The Curzon Gateway student accommodation blocks will be demolished as part of the construction of the Proposed Scheme, due to the alignment of the Curzon Street No.3 viaduct, which will pass directly through the current location of the accommodation blocks. The permanent loss of the flats is considered to be a major adverse effect, and is therefore significant.

Open space and recreational PRow

- 5.4.46 An area of Eastside City Park, approximately 8,500m² (27% of the total park area) will be removed permanently. The majority of this area (approximately 6,900m²) will be developed as the Curzon Promenade, a large area of public realm to the north of the

proposed Curzon Street station, and will integrate with Eastside City Park. The majority of the remaining removed parkland, approximately 1,400m², is required for the realignment of New Canal Street to the west of the Grade II listed Woodman public house. The realignment is required to protect the Grade I listed wall associated with the former Curzon Station building. The realigned road will be lined with planting to integrate the road with Eastside City Park. In addition, a small area will be required for the Curzon Street station footprint.

- 5.4.47 It is considered that the permanent removal of approximately 27% of Eastside City Park will not impair the overall function of the park as the majority of this land will be developed as an area of public realm that will integrate with the park. This will be a minor adverse effect and is therefore not considered to be significant.
- 5.4.48 Park Street Gardens will be lost permanently due to land required for the construction and operation of Curzon Street station. The gardens will form part of the location of the seven tracks and associated platforms where the structures extend from the west of New Bartholomew Street to Park Street. This will include a roof and canopy structure that will span the length of the platforms. Part of the northern area of Park Street Gardens (approximately 2,400m²) will be developed as part of the proposed Curzon Promenade to the north of Curzon Street station.
- 5.4.49 There is a lack of parkland within Birmingham city centre and the quality of public open space within the city is rated as being of “generally not good” standard²³. Park Street Gardens is therefore an important resource. The heritage value of the site makes it an interesting and unique open space with gravestones evidencing its previous use as a formal burial ground. The permanent loss of Park Street Gardens will result in a major adverse effect and is therefore considered to be significant.

Cumulative effects

- 5.4.50 No cumulative or community wide effects on community resources have been identified in this section.

Other mitigation measures

- 5.4.51 The assessment has concluded that there are significant adverse effects arising during construction in relation to a number of community resources.
- 5.4.52 It is the intention to work with the affected parties to put in place an agreement which will deliver necessary mitigation measures as outlined below:
- Arya Samaj Vedic Mission: HS2 Ltd will continue to work with the owners 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; and
 - West Midlands Fire Service Headquarters: HS2 Ltd will continue to work with the West Midlands Fire Service, to identify a suitable means of relocating

²³ Birmingham City Council, (2006) *The Future of Birmingham's Parks and Open Spaces: Supplementary Planning Document*.

and/or reconfiguring the functional uses of the rear service yard and the staff car parking displaced by the Proposed Scheme.

Summary of likely significant residual effects

- 5.4.53 The construction of the Proposed Scheme will result in the demolition of 12 residential properties on Common Lane in Washwood Heath and Curzon Gateway student accommodation, Curzon Street and the Arya Vedic Mission Vedic building community facility at Erskine Street.
- 5.4.54 There will be a permanent loss of public open space at Park Street Gardens due to construction of Curzon Street station. Eastside City Park and the West Midlands Fire Service headquarters will be affected due to both the temporary and permanent loss of land required for the construction and operation of the Proposed Scheme. Millennium Point would be temporarily isolated due to the construction of the Proposed Scheme.
- 5.4.55 There will be temporary effects on the amenity of residents at properties on Common Lane, Warren Road, Northumberland Street, Vauxhall Grove, Vauxhall Road, Curzon Gateway, Masshouse Hive, Etna Street and Bordesley Street during construction. Future residential developments at Eastside Locks, Typhoo Wharf, Masshouse Hive and Masshouse Plot 7 would also experience adverse amenity effects.
- 5.4.56 In addition, the amenity of staff and pupils at the Leigh Junior, Infant and Nursery School, Hasanat College and the Parkside Building, the users of Masjid Ali Mosque, Eastside City Park, Think Tank Museum Science Garden and the Polish Centre will be temporarily affected. The staff and students at the proposed new teaching facilities at Birmingham City University in Eastside would also likely experience adverse amenity effects.

5.5 Effects arising from operation

Avoidance and mitigation measures

- 5.5.1 No additional specific measures have been incorporated into the Proposed Scheme design as part of the design development process to avoid or minimise environmental impacts on community facilities and residential properties during operation. Measures that help reduce effects on amenity, such as noise and visual effects are detailed in the relevant topic sections.

Assessment of impacts and effects

- 5.5.2 No likely significant effects have been identified during operation.

Cumulative effects

- 5.5.3 The proposed Curzon Street station will be the western terminus of the Proposed Scheme located at land south of Curzon Street with Moor Street Queensway to the western extent and Curzon Gateway to the east. It is considered that the development of the station will provide a community wide benefit in regard to improvements to the public realm, accessibility and the contribution it will make to the regeneration of Eastside.

- 5.5.4 The station location is within the central area of the Eastside quarter of Birmingham city and will make a significant contribution to the regeneration of Eastside as is recognised in the Eastside Masterplan. In particular the station will bring new areas of public open space and provide connectivity between the Eastside quarter, the core area of the city and Digbeth to the south. This will include a series of areas of public realm from Moor Street Queensway and linking to Eastside City Park including, the Station Square, Curzon Promenade and Curzon Square (for more information on these see the discussion of public realm in Section 2.2). The station will bring an increase in local footfall, which will contribute to the vibrancy of areas of public realm and Eastside City Park.
- 5.5.5 The location of the proposed Curzon Street station will require the closure of a number of existing roads and pedestrian routes. The station design seeks to mitigate these impacts by enhancing the connectivity between Digbeth, Eastside and Moor Street Queensway with the provision of new pedestrian routes along the south-west edge of the station and areas of public realm linking to the north of the station. The existing link from Digbeth to Curzon Street will be maintained with the realignment of New Canal Street running beneath the station and linking to the proposed Curzon Square. There will be a pedestrian entrance to the station from Bordesley Street and Park Street, at the south side of the station, north of the Rugby to Birmingham line, and at Andover Street to the east of the station. Both entrances will provide direct access into the station, in the form lifts and escalators to allow for the vertical difference in levels. The pedestrian route from Bordesley Street and Park Street could also be used to access the Station Square area and Moor Street Queensway.
- 5.5.6 The proposed Curzon Street station will help maximise the regeneration potential of Eastside and contribute to the implementation of the Eastside Masterplan. It is considered that this will have a beneficial effect on a significant proportion of people within the wider community within the Eastside and Digbeth area and city wide. It is therefore considered that the beneficial effects of Curzon Street station will result in significant improvements to the connectivity and the provision of public realm at the community wide level.

Other mitigation measures

- 5.5.7 The above assessment has concluded there are no significant adverse effects arising during operation, therefore no further mitigation is proposed at this stage.

Residual significant effects

- 5.5.8 No residual significant effects have been identified.

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 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 Community Forum Area (CFA) Map books. Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5: Maps CH-01-160b to CH-01-163 and CH-02-156b to 158-R1. Detailed reports on the cultural heritage character undertaken within the local area are contained in the Volume 5 Appendices. These include:
- CH-001-026 Baseline report;
 - CH-002-026 Gazetteer of heritage assets; and
 - CH-003-026 Impact assessment table.
- 6.1.4 Throughout this section, assets within the study area are identified with a unique reference code WCSxxx, further details of these assets can be found in the Volume 5: Appendix CH-002-026.
- 6.1.5 Engagement has been undertaken with the Birmingham City Council (BCC) planning archaeologist with regard to the nature of the cultural heritage assets within the Washwood Heath to Curzon Street local 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-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.
- 6.2.2 The setting of all designated heritage assets within 2km of the centre line of the route 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 or permanently, to construct the Proposed Scheme plus 250m.
- 6.2.3 The cultural heritage methodology includes the consideration of the intra-project effects of a number of technical assessments, for example, 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 Due to the urban nature of the study area, no non-intrusive field survey was undertaken to provide data regarding the nature of sub-surface archaeological assets. Information from other sources of data, including the Historic Environment Record²⁴ 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-001-026.
- 6.3.2 In addition to collation of this baseline data, walkover 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: Appendix CH-003-026 and Volume 5: Maps CH-01-160b to CH-01-163 and CH-02-156b to CH-02-158-R1):
- one Grade I listed building; the British Rail Goods Office – the former Curzon Street Station building, including the balustrade stone wall – (WCS041);
 - four Grade II listed buildings; Old Moor Street station (WCS038), the Fox and Grapes public house (WCS051), the 1838 railway bridge into Curzon Street over the Digbeth Branch Canal (WCS075) now encompassed within canal tunnel and Lawley Street railway viaduct (WCS024); and
 - two conservation areas; Warwick Bar Conservation Area²⁵ (WCS027) and Digbeth, Deritend and Bordesley High Streets Conservation Area²⁶ (WCS039).
- 6.3.4 The following designated assets are located within the 2km study area (see Volume 5: Maps CH-01-160b to CH-01-163 and CH-02-156b to CH-02-158-R1):
- 564 listed buildings, the majority of which are located within the city centre where they form part of wider city centre conservation areas, principally located within the Colmore Row and Environs Conservation Area²⁷ (WCS057), the Steelhouse City Centre Conservation Area²⁸ (WCS049), and the Jewellery

²⁴ Heritage Gateway; Historic Environment Records; <http://www.heritagegateway.org.uk/Gateway/CHR>; Accessed June 2013.

²⁵ Birmingham City Council, <http://www.birmingham.gov.uk/warwickbarca>; Accessed June 2013.

²⁶ Birmingham City Council, <http://www.birmingham.gov.uk/digbethderitendca>; Accessed June 2013.

²⁷ Birmingham City Council, <http://www.birmingham.gov.uk/colmorerowca>; Accessed June 2013.

²⁸ Birmingham City Council, <http://www.birmingham.gov.uk/steelhouseca>; Accessed June 2013.

Quarter Conservation Area²⁹ (WCS059). Others are identified as individual structures within the urban and suburban streetscape of the city, such as the Grade II* listed Birmingham Gun Barrel Proof House (WCS058), the Grade II listed Church of St. Michael (WCS054), and the Grade II listed Canal Side Warehouse (included with the asset grouping WCS030 which comprises much of the 19th century canal and industrial streetscapes in Digbeth) and the Woodman public house (WCS055);

- ten conservation areas; Warwick Bar (WCS027), Digbeth, Deritend and Bordesley High Streets (WCS039), Steelhouse City Centre (WCS049), Jewellery Quarter (WCS059), Colmore Row and Environs (WCS057); Ideal Village (WCS002); Aston Hall and Church (WCS023); Ryland Road (WCS062); Lee Crescent (WCS061), and Edgbaston (WCS060); and
- three registered historic parks and gardens (RPG); Key Hill Cemetery (WCS064), Warstone Lane Cemetery (WCS063), and Aston Hall (WCS028).

Non-designated assets

6.3.5 Park Street Burial Ground (WCS048) is a non-designated asset of high value which lies wholly within the land required temporarily or permanently for the construction of the Proposed Scheme.

6.3.6 The following non-designated assets of moderate value lie wholly or partially within the land required temporarily or permanently for the construction of the Proposed Scheme:

- five locally listed buildings: Washwood Heath no 1 signal box (WCS009), the Midland Tavern public house (WCS065), the Ashted Canal Locks (WCS074), the Eagle and Tun public house (WCS034) and a public urinal on Banbury Street (WCS077);
- the wall on the south side of Curzon Street (WCS076), the standing remains of former station buildings facing Curzon Street as well as the remains of those and other related buildings that lie buried beneath the existing car park (WCS078);
- the Digbeth Branch Canal (WCS073);
- archaeological assets; comprising evidence for medieval and post-medieval settlement at Digbeth/Deritend (WCS022), and occupation sites along Freeman Street (WCS044, WCS042); and
- four important hedgerows; located south of the B4132 Curzon Street (WCS032); located on the western bank of the Grand Union Canal parallel to Crawford Street (WCS015), located parallel to the River Rea and the A47 Heartlands Parkway (WCS013), and located south of Aston Church Road on the western bank of the Grand Union Canal (WCS012).

²⁹ Birmingham City Council, <http://www.birmingham.gov.uk/jewelleryquarterca>; Accessed June 2013.

6.3.7 The following non-designated assets of low value lie wholly or partially within the land required temporarily or permanently for the construction of the Proposed Scheme:

- five built heritage assets; buildings comprising the former Washwood Heath railway works (WCS003), the Stechford and Aston rail overbridge (WCS007), the Aston Church Road overbridge (WCS008), and the Saltley Viaduct (WCS014); and
- 15 archaeological assets including the site of the Curzon Street pumping station (WCS072), the site of the Baptist Meeting House, Freeman Street (WCS046) and the site of Gough's Hide Yard (WCS047).

6.3.8 All non-designated heritage assets within 250m of the land required temporarily or permanently to construct the Proposed Scheme are listed in the gazetteer in Volume 5: Appendix CH-002-026 and identified on Volume 5: Maps CH-01-160b to CH-01-163). There are a number of built heritage assets with upstanding remains, the settings of which have been considered, for example:

- 12 locally listed buildings of moderate value (included within asset group WCS030) located within the Digbeth, Deritend and Bordesley High Streets Conservation Area;
- 14 locally listed buildings of moderate value (included within asset group WCS031) located within the Warwick Bar Conservation Area; and
- ten locally listed structures of moderate value including; the Moriarty's public house (WCS029), the Ashcroft Estate (WCS052), the culverted River Rea (WCS068), the Argyle works (WCS053), the former Corporation Cottage baths (WCS069), the former Hutton's Brewery (WCS019), the Albion Vaults public house (WCS067), the Metro Cammell Limited offices (WCS070), the Leigh Junior, Infant and Nursery School (WCS004), and the Bethel Evangelical Church (WCS066).

Cultural heritage overview

6.3.9 The study area lies within the densely urbanised parts of Birmingham city centre, sitting within the Knowle Basin. The study area is heavily built up with pockets of greenspace provided by amenity land. The Rivers Tame and Rea pass through the area in wide, shallow river valleys. The underlying solid geology of the study area consists entirely of Mercia Mudstone. This is overlain by widespread deposits of alluvium and river terrace deposits associated with the Rivers Tame and Rea. Throughout the study area there are significant areas of made ground, which is the result of continuous development.

6.3.10 The only evidence for prehistoric activity within the study area comprises deposits including tree boles (the depression resulting from the removal of the root ball) with worked flints of the Late Upper Palaeolithic and Early Mesolithic at the base recovered from the Eastside area of the city (WCS035). This may be due to research bias or a lack of excavation activity within the study area. However, 400m beyond the study area evidence of Pleistocene deposits – referred to as the 'Nechells interglacial deposits' – have been recorded. Whilst they lie outside of the study area, these deposits are

significant in understanding the environment during the interglacial period up to the last Ice Age within the area. In the north of Birmingham and at Cardigan Street, Duddeston, silt and clay drift deposits have been located within areas of gravel from pre-glacial valleys. Between 1950 and 1961, a number of boreholes and excavations were undertaken providing detailed information on the stratigraphy as well as for lithology, floral and faunal analysis of these Nechells deposits³⁰. Through this work, invaluable data relating to the interglacial environment has been noted, including evidence of mixed oak forests developing from open 'sub-arctic' scrub. It is considered that whilst these areas of interglacial deposits are not located within the study area, there still remains the possibility for isolated interglacial beds to be found within the areas of Nechells Green and Washwood Heath.

- 6.3.11 The later prehistoric period from the Neolithic onwards is similarly lacking in the archaeological record within the study area. There is evidence in the immediate surrounding area for activity, particularly dating from the Bronze Age in the form of burnt mounds in Castle Bromwich; however none have been located within the study area. Once again, this could be due to a lack of investigation.
- 6.3.12 The Roman road Ryknild (Icknield) Street which linked Metchley Roman Fort (now centred on Vincent Drive, Edgbaston) with Alcester to the south, and Wall and Watling Street to the north passes through the city³¹. Although there is evidence of Roman activity in the wider surrounding locality, the only record within the study area is limited to the find of a Roman coin at the Washwood Heath former Metropolitan-Cammell works and pottery finds from Moor Street³² and Park Street³³. This lack of evidence is probably due to the lack of a settlement within Birmingham during this period, with activity limited to isolated farmsteads.
- 6.3.13 Birmingham is an early medieval (Anglo-Saxon) name meaning 'homestead of the Beormingas (people of Beorma)'³⁴. Settlement within the study area was established during the early medieval period. There is a suggested nucleus between Curzon Street and Hockley Brook where an initial settlement was established. At the time of the Domesday Survey (1086), Birmingham was a part of the 'Coleshill' Hundred (a large administrative subdivision of land) together with 49 other settlements including Aston, Curdworth and Castle Bromwich.
- 6.3.14 In 1166, Peter, Lord of Birmingham, obtained a royal charter to hold a market at his castle. Following the granting of this charter, the town went through a period of rapid economic growth³⁵. Within a century, the settlement transformed into a prosperous manufacturing and market town. The limits of the town have been suggested to have been formed by a watercourse in the south that extended from Birmingham Moat which surrounded the medieval manor house in the east, to the Parsonage Moat in

³⁰ Kelly, M. R., (1964), *The Middle Pleistocene of North Birmingham*, 533-592, in *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences*, No. 741, Volume 247.

³¹ Margary, I., (1973), *Roman Roads in Britain*, third edition. Baker.

³² Mould, C., (2000), *An Archaeological Evaluation and Excavation at Moor Street, Birmingham City Centre 2000, Post-excavation Assessment and Research Design*. Project No. 687. Birmingham University Field Archaeology Unit.

³³ Hodder, M., (2004), *Birmingham the Hidden History*. Tempus.

³⁴ Cameron, K., (1997), *English Place-Names*. Batsford.

³⁵ Holt, R., (1985), *The Early History of the Town of Birmingham 1166-1600*. Dugdale Society, Oxford.

the west³⁶. From here, the boundary of the town may have extended northwards (possibly on the line of the historical alignment of Worcester Street, near to the Rotunda) and then turned south-east to run parallel with the current marketplace and Digbeth, before turning west to cross Digbeth to join the Birmingham Moat. This north-eastern boundary is thought to be the earthwork known as the 'Hersum Ditch' (WCS033), which is mentioned in documents from the 14th to 17th century, as a property boundary located on the east side of Moor Street.

- 6.3.15 Within the town boundary is the parish church of St. Martin (WCS056) which, although of predominantly 17th and 18th century date, is believed to have 13th century origins. Evidence for commercial activity and domestic settlement during the medieval period can be seen in the Moor Street and High Street areas, where evidence for settlement activity comprising ditches, wells and pits have been identified (forming part of asset group WCS033), and extending to Freeman Street where a number of pits containing medieval pottery (together with 18th century cellar walls and yards) have been recorded (WCS042). In Park Street, ditches, pits, graves and timber lined tanks have all been uncovered indicating not only the presence of settlement but also of local scale industry, perhaps in the form of a tannery (within asset group WCS030). Evidence for medieval landscape division is also represented by a north-south aligned ditch (WCS030) situated on the eastern boundary of Park Street Gardens burial ground.

- 6.3.16 The growth of the medieval town was accompanied by a growth in industry which was not just confined to the nucleus of the town. Within the study area sites of mills outside of the city area are recorded at Duddeston Watermill (WCS018) located within Vauxhall, adjacent to Duddeston Mill Road and at Willet's Meadow Mill (WCS025), located near Garrison Lane Park.

- 6.3.17 The utilisation of natural resources principally the watercourses, continued into the post-medieval period and led to the establishment of Birmingham as a centre for industrial activity. Industrial growth during the 17th century led to population growth and expansion of the urban centre. Freeman Street (WCS044) was laid out in the 18th century between 1727 and 1731 and the Fox and Grapes public house (WCS051) represents the only surviving element of this development. Freeman Street was part a newly established regular street grid pattern which overlay and cut across the existing irregular street pattern which had been based on land ownership.

- 6.3.18 Continued growth and expansion of the city was stimulated by the arrival of the canal network. The creation of the canals allowed a much more stable and predictable method of transport route rather than the potentially unpredictable and uncontrolled rivers. This allowed a much higher level of importation of raw materials to come into the city, spurring on increased output of finished products which could then be exported in greater quantities. Canal building in this area started in the 1790s with the Digbeth Branch Canal (WCS073), the Birmingham and Fazeley Canal and the Warwick and Birmingham Canal. Prior to the arrival of the canal, the area south of the town was largely undeveloped with occupation limited to the River Rea valley.

³⁶ Hodder, M., (2004), *Birmingham the Hidden History*. Tempus.

- 6.3.19 Following the establishment of the canal network new industries were set up and new premises fronted directly to the canal. Notable survivals of these new premises include the Birmingham Gun Barrel Proof House (WCS058). Partial survivals include the Minerva Works canal boundary wall (included with asset group WCS030) and surfaces adjacent to the Digbeth Branch Canal. The development of warehouses and workshops was not confined to the canal side, but extended into the newly laid out streets with surviving 19th century examples at the premises of the former Christopher Wray Lighting Company (included within asset group WCS031) and Nos. 17 and 18 and 101 New Canal Street (included within asset group WCS030).
- 6.3.20 The arrival of the railways in the early 19th century exploited the relatively underdeveloped River Rea valley as a natural transport corridor into Birmingham and Curzon Street became the terminus for two major railway companies; the London and Birmingham Railway and the Grand Junction Railway.
- 6.3.21 The London and Birmingham Railway was completed in 1838 and was the first mainline railway to enter London, providing a link between the capital and the burgeoning industrial centre at Birmingham. The 112 miles (180 km) were surveyed by Robert Stephenson whilst Philip Hardwick designed both the Euston terminus in London and the Curzon Street terminus in Birmingham (WCS041). The railway approached Birmingham from the east, and as it entered Curzon Street it was carried on a bridge (WCS075) over the Digbeth Branch Canal. The station buildings including the passenger platforms and other related structures (WCS078) were arranged alongside Curzon Street behind a screen façade elements of which remain within the existing Curzon Street wall (WCS076). A railway goods yard (part of asset group WCS031) was located on the north side of Curzon Street.
- 6.3.22 The London and North Western Railway formed in 1846 from a merger between the London and Birmingham Railway and the Grand Junction Railway, was in a much stronger position to continue the railway from the Curzon Street terminus to a more convenient site within the city centre. Plans for the extension were submitted in 1846 with the line running to the south of the Curzon Street site to a new station site at New Street. The new lines required heightening of the Lawley Street railway viaduct (WCS024) and extensive widening of the existing bridge over the Digbeth Branch Canal effectively putting the canal into tunnel. The opening of New Street station led to a decline in passenger services from Curzon Street which ceased in 1893, after which Curzon Street was used for goods before finally closing in 1966.
- 6.3.23 The Great Western Railway made an unsuccessful attempt to bring a line to Birmingham in the 1840s, but by 1852 it was able to open a new passenger station at Snow Hill to the north of the city centre. The Great Western Railway entered the city from the south on the Bordesley Viaduct (within asset group WCS030) before entering into tunnel to emerge at Snow Hill. The Snow Hill tunnel prevented the laying of further lines to accommodate increasing demand and in 1909 temporary station buildings were provided at Moor Street at the southern end of the tunnel. A permanent station building at Moor Street (WCS038) including an extensive goods yard beneath the approach viaduct was opened in 1914.
- 6.3.24 The Birmingham and Derby Junction Railway had its terminus on a site off Lawley Street, currently the Freightliner Terminal Depot though none of the original station

buildings remain. The Lawley Street terminus contained passenger and freight facilities, locomotive maintenance and repair shops. A new marshalling depot and carriage works was later established at Washwood Heath (WCS003) which opened in 1877 as a marshalling line for wagons. The site was conveniently located adjacent to Joseph Wright and Sons carriage works (subsequently known as Metropolitan Railway Carriage and Wagon Company Ltd). The site was latterly used as a parts factory by Leyland DAF Vans (LDV). Much of the factory has since been demolished. Accommodation for the railway and engineering workers was provided along Leigh Road including community facilities such as the Leigh Junior, Infant and Nursery School (WCS004).

- 6.3.25 The establishment of premises for social and leisure pursuits within the study area is in evidence from an early period; a playhouse was established on Park Street by 1750 (WCS043). From the 18th century, throughout the 19th century and into the mid-20th century the area witnessed the establishment of a number of public houses including the Fox and Grapes public house on Freeman Street (WCS051), the Woodman public house (WCS055), the Eagle and Tun public house (WCS034) and the Midland Tavern public house (WCS065). Further afield are the Eagle and Ball on Penn Street (WCS031), the Spotted Dog on Bordesley Street (WCS081), the Albion Vaults on Cato Street North (WCS067), the Former Hutton's Brewery Building (WCS019), and Moriarty's public house on the A4540 Lawley Middleway (WCS029).
- 6.3.26 The population of the city expanded rapidly during the 19th century and in 1810 the burial ground at Park Street Gardens (WCS048) was established as an over-flow burial ground for the nearby St. Martin's Church whose burial ground was at full capacity. The Park Street site was used for the internment of thousands of people from all classes, however, its detachment from St. Martin's Church meant it was considered as an undesirable location and the site became a burial site for the poor. The site closed in 1873 as a consequence of a city wide order issue by the Secretary of State in response to public health concerns.
- 6.3.27 By the mid-19th century, in response to the demand for new industrial and residential sites, outlying areas of development were established along the routes leading out of Birmingham. In the early 20th century, the city council's policy was to concentrate commercial development close to the city centre and much of the character of Digbeth and Bordesley derives from this period. Some of the residents displaced by this process were rehoused on the Ashcroft Estate (WCS052), which opened in the 1930s.
- 6.3.28 The success of Birmingham during the Industrial Revolution and the establishment of such a large number of important industrial sites in the region; also led to the area being a prime target for German bombers during World War II. From the period between 1940 and 1943, around 2,000 tonnes of explosive were dropped on the city centre. The post-war period saw the creation of redevelopment areas around the centre of Birmingham to provide self-contained 'new towns'; to house communities, complete with shopping centres, open spaces, churches, schools, and other public buildings.
- 6.3.29 The historic development of the landscape within the study area is defined by urbanisation of an industrial character particularly within the city centre which has

removed the legibility of any preceding historic landscape. The railways with their strong linear lines and high viaducts dominate and frame many of the streetscape approaches to the city, and define much the present and historic character. It is considered that the Proposed Scheme will represent a continuation of this pattern of railway infrastructure and so contributing to existing character.

Future baseline

Construction (2017)

- 6.3.30 Volume 5: Appendix CT-004-000 identifies future and permitted development proposals that will form part of the baseline for construction. The potential for these developments to alter the current cultural heritage baseline has been reviewed as part of this assessment.
- 6.3.31 Various developments associated with Eastside City Park Gate will be effective in restoring the built-up character of the Digbeth Branch Canal, around the Ashted Locks, and including parts of the Warwick Bar Conservation Area, and the urban streetscape of Belmont Row. Specific developments include:
- a mixed use development 'student hub' including formal teaching areas as part of the Birmingham City University Campus at land bounded by Gopsal Street, Cardigan Street, Curzon Street and Digbeth Branch Canal within the Eastside area of the city (2012/04578/PA);
 - erection of a five storey building for education use with associated access, parking and landscaping at Cardigan Street on land adjoining Millennium Point, Eastside (2011/00453/PA); and
 - the redevelopment of Eastside Locks comprising mixed use development including 475 residential units (2008/02942/PA).
- 6.3.32 The assessment of impacts arising from the construction of the Proposed Scheme therefore assumes that these developments have removed the existing open vistas towards the Proposed Scheme.

Operation (2026)

- 6.3.33 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.

6.4 Effects arising during construction

Avoidance and mitigation measures

- 6.4.1 The following design measures have been incorporated into the design of the Proposed Scheme to reduce impacts on assets:
- minimisation of the area of land required for the construction of the Proposed Scheme to reduce both physical and setting impacts on heritage assets in the vicinity of the proposed Curzon Street station, including impacts on the Warwick Bar Conservation Area (WCS027);

- minimisation of the area of land required for the construction of the Proposed Scheme specifically to allow retention of the locally listed Midland Tavern public house (WCS065); and
- consideration of design height to allow incorporation, although with modification, of the locally listed Eagle and Tun public house (WCS034) within the proposed Curzon Street station.

6.4.2 The draft CoCP sets out the provisions that will be adopted to control construction effects on cultural heritage assets. The provisions include the following (see Volume 5: Appendix CT-003-000) which are detailed in Section 8 of the draft CoCP:

- management measures that will be implemented for assets that are to be retained within the land required for the construction of the Proposed Scheme;
- the preparation of project wide principles, standards and techniques for works affecting heritage assets;
- a programme of archaeological investigation and recording to be undertaken prior to/or during construction works affecting the assets; and
- a programme of historic building investigation and recording to be undertaken prior to modification or demolition of the assets.

Assessment of impacts and effects

Temporary effects

- 6.4.3 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.
- 6.4.4 The following significant effects will occur as a result of temporary impacts on the setting of designated or non-designated heritage assets.
- 6.4.5 The British Rail Goods Office (former Curzon Street Station building) (WCS041), an asset of high value, will be affected by the erection of hoarding, lighting, and the establishment of the Curzon Street station main compound which will impact on its setting. This will be a medium adverse impact and a major adverse effect. The Curzon Street main compound will be present for approximately seven years.
- 6.4.6 The Woodman public house (WCS055), an asset of moderate value, will be affected by the construction of the Curzon Street station, the establishment of the Curzon Street main compound, materials storage and lighting. This will be a medium adverse impact and a moderate adverse effect. Construction activity will take place intermittently over approximately five years. The Curzon Street main compound will be present for approximately seven years.
- 6.4.7 The 1838 railway bridge into Curzon Street over the Digbeth Branch Canal (WCS075), an asset of moderate value, will be affected by construction activities associated with

the Curzon Street No 3 viaduct. This will be a medium adverse impact and a moderate effect. Construction activity will take place over approximately two years.

- 6.4.8 Ashted Locks (WCS074), an asset of moderate value, will be affected by construction activities associated with the Curzon Street No 3 viaduct. This will be a medium adverse impact and a moderate adverse effect. Construction activity will take place over approximately two years.

Cumulative effects

- 6.4.9 It is not considered that there will be any cumulative effects from temporary impacts on heritage assets within the study area.

Permanent effects

- 6.4.10 The following significant effects will occur as a result of physical impacts on heritage assets within the land required temporarily or permanently for the construction of the Proposed Scheme.
- 6.4.11 A hedgerow (WCS032) located south of the B4132 Curzon Street, an asset of moderate value, will be removed to construct the Curzon Street No 3 viaduct and site access routes. This will be a high adverse impact and a major adverse effect.
- 6.4.12 The Eagle and Tun public house (WCS034), an asset of moderate value, will be altered by removal of its roof and incorporation of the building into the structure of the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.
- 6.4.13 The Eastside prehistoric deposits (WCS035), an asset of moderate value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.
- 6.4.14 Freeman Street (WCS044) and associated archaeological deposits (WCS042), assets of a moderate heritage value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.
- 6.4.15 Park Street burial ground, a disused 19th century cemetery (WCS048), an asset of high value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.
- 6.4.16 The Fox and Grapes public house (WCS051), an asset of moderate value, will be demolished to construct the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.
- 6.4.17 A public urinal on Banbury Street (WCS077), an asset of moderate value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.
- 6.4.18 The site of the former Curzon Street station buildings (WCS078), an asset of moderate value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.

- 6.4.19 The former Washwood Heath railway works depot buildings (WCS003), an asset of low value, will be demolished to construct the proposed Washwood Heath depot. This will be a high adverse impact and a moderate adverse effect.
- 6.4.20 The Stechford and Aston rail overbridge (WCS007), an asset of low value, will be demolished to construct the Washwood Heath rail overbridge. This will be a high adverse impact and a moderate adverse effect.
- 6.4.21 The Aston Church Road overbridge (WCS008), an asset of low value, will be demolished to enable the realignment of the proposed Aston Church Road overbridge. This will be a high adverse impact and a moderate adverse effect.
- 6.4.22 The Saltley Viaduct (WCS014), an asset of low value, will be demolished to construct the B4114 Saltley viaduct. This will be a high adverse impact and a moderate adverse effect.
- 6.4.23 Archaeological deposits associated with the Digbeth/Deritend settlement (WCS022), an asset of moderate value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a major adverse effect.
- 6.4.24 The ditch located on the east side of Park Street (WCS040), an asset of low value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a moderate adverse effect.
- 6.4.25 The site of a theatre (WCS043), an asset of low value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a moderate adverse effect.
- 6.4.26 The site of a house, workshop on Freeman Street (WCS045), an asset of low value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a moderate adverse effect.
- 6.4.27 The site of the Baptist Meeting House on Freeman Street (WCS046), an asset of low value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a moderate adverse effect.
- 6.4.28 The site of Gough's Hide Yard (WCS047), an asset of low value, will be removed to construct the proposed Curzon Street station. This will be a high adverse impact and a moderate adverse effect.
- 6.4.29 The site of the Curzon Street Pumping Station (WCS072), an asset of low value, will be removed by the construction of an access road into the proposed Curzon Street station car park. This will be a high adverse impact and a moderate adverse effect.
- 6.4.30 The following significant effects will occur as a result of permanent impacts on the setting of heritage assets.
- 6.4.31 The Lawley Street railway viaduct (WCS024), an asset of moderate value, will have its setting affected by the presence of the proposed Curzon Street No.2 viaduct. The viaduct will not physically impact on the asset; however, the structure is a dominant feature within the surrounding streetscapes and will permanently prevent views of a large section of the historic aspect. This will be a medium adverse impact and a moderate adverse effect.

- 6.4.32 The Woodman public house (WCS055), an asset of moderate value, will have its setting affected by the presence of the proposed Curzon Street station. While it will be effective in restoring the urban streetscape, the new station will have a dominating effect. This will be a medium adverse impact and a moderate adverse effect.
- 6.4.33 The British Rail Goods Office (the former Curzon Street Station building) (WCS041), an asset of high value, will be affected by the presence of the proposed Curzon Street station. This will significantly alter the setting of the historic asset through the introduction of a new built element adjacent to it. While the new station will be effective in restoring the historic railway setting of the asset, it will have a dominating effect within the streetscape. This will be a low adverse impact and a moderate adverse effect.
- 6.4.34 Ashted Canal Locks (WCS074), an asset of moderate value, will be affected by the presence of the proposed Curzon Street No 3 viaduct which will disrupt key views towards the city centre. This will be a medium adverse impact and a moderate adverse effect.
- 6.4.35 The 1838 section of railway bridge into Curzon Street station over Digbeth Branch Canal (WCS075), an asset of moderate value, will be affected by the presence of the proposed Curzon Street No 3 viaduct and Curzon Street station which will interrupt views of the northern portal including key views from south along the canal. This will be a medium adverse impact and a moderate adverse effect.
- 6.4.36 The historic development of the landscape within the study area is defined by urbanisation of an industrial character particularly within the city centre which has removed the legibility of any preceding historic landscape. The railways with their strong linear lines and high viaducts dominate and frame many of the streetscape approaches to the city, and define much the present and historic character. It is considered that the Proposed Scheme will represent a continuation of this pattern of railway infrastructure and so contributing to existing character.

Cumulative effects

- 6.4.37 There are no inter-project effects considered to be of specific relevance to the cultural heritage topic.

Other mitigation measures

- 6.4.38 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the draft CoCP will be considered during detail design to reduce further the significant effects described above. These refinements will include the identification of:
- suitable locations for advance planting, to reduce impacts on setting of assets; and
 - locations where there is physical impact on below ground assets can be reduced through the design of earthworks.

Summary of likely residual significant effects

- 6.4.39 Construction of the Proposed Scheme will result in the loss of heritage assets including former railway depot buildings at Washwood Heath (WCS003), the burial ground at Park Street Gardens (WCS048), the Fox and Grapes public house (WCS051), archaeological deposits associated with the former Curzon Street station (WCS022) and medieval remains at Freeman Street (WCS042). The Eagle and Tun public house will experience a significant adverse effect on its setting as the building will be permanently altered as a result of its incorporation into the Curzon Street station.
- 6.4.40 While the new station at Curzon Street will be effective in restoring the historic railway setting of the Grade I listed British Rail Goods Office (the former Curzon Street Station building) (WCS041), it will have a dominating effect within the streetscape and will have an adverse effect on its setting. The construction of viaducts and the station in this area will also have adverse effects on the setting of the Lawley Street Railway Viaduct (WCS024), the Woodman public house (WCS055), Ashted Canal Locks (WCS074), the 1838 section of railway bridge into Curzon Street station over Digbeth Branch Canal (WCS075).

6.5 Effects arising from operation

Avoidance and mitigation measures

- 6.5.1 There are no further design measures required to mitigate the operational effects on heritage 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 scheme and its operation, this is reported in the assessment of operation.
- 6.5.3 There are no assets identified that will experience significant additional permanent change to their setting as a result of the operation of the Proposed Scheme, hence there are no likely significant effects predicted to occur.

Cumulative effects

- 6.5.4 Assessment of inter-project effects on cultural heritage assets arising from the interaction of the Proposed Scheme with cumulative development projects has been undertaken. These are listed in Volume 5: Appendix CT-004-000 and mapped on Volume 5: Maps CT-13-068b to CT-13-070. No significant cumulative effects have been identified in relation to cultural heritage.

Other mitigation measures

- 6.5.5 The Proposed Scheme includes a number of design measures to address potential impacts and significant effects. No additional operational mitigation measures beyond those included within the Proposed Scheme design have been identified. Potential opportunities for further mitigation have not been identified, but will be considered as part of the detailed design process.

Summary of likely residual significant effects

- 6.5.6 No likely residual significant effects are predicted.

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 issue in this area is the loss of acid grassland at the Land at Warren Road Site of Local Importance for Nature Conservation (SLINC).
- 7.1.3 Volume 5 of the ES contains supporting information to the ecological assessment reported in this section, including:
- ecological baseline data (Volume 5: Appendix EC-001-004, EC-002-004, EC-003-004 and EC-004-004); and
 - register of local/parish level effects which are not described individually in Volume 2 (Volume 5: Appendix EC-005-004).
- 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: Birmingham City Council (BCC); Canal and Rivers Trust (formerly British Waterways); EcoRecord (the biological records centre for Birmingham and the Black Country); Environment Agency; and Birmingham and the Black Country Wildlife Trust.

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: Appendix EC-001-004, EC-002-004, EC-003-004 and EC-004-004.
- 7.2.2 A Water Framework Directive (WFD) assessment³⁷ 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 Initial assessment did not identify any habitats which merited further detailed survey for the following species and groups: wintering and passage birds; hazel dormouse; otter; fish; terrestrial invertebrates and white-clawed crayfish. Otter surveys were not required as the watercourses (including the River Tame) in proximity to the Proposed Scheme did not provide suitable habitat for this species. Whilst the watercourses may support fish, suitable habitats subject to effects from construction or operation of the Proposed Scheme were not identified.

³⁷ European Parliament and of the Council (2000) The Water Framework Directive – *Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy*, Europa Commission.

- 7.2.4 Access was not obtained to all of the land area where general habitat survey (Phase 1 habitat survey) was proposed. Locations with the potential to support ecological receptors where access was not gained for survey include the complex of land ownerships contained within the area of land identified for the proposed Washwood Heath depot. Further details are provided in Volume 5: Appendix EC-001-004, EC-002-004, EC-003-004 and EC-004-004.
- 7.2.5 Where data are limited, a precautionary baseline has been built up according to the guidance reported in Volume 5: Appendix CT-001-000/2. This constitutes a 'reasonable worst case' basis for the subsequent assessment.
- 7.2.6 The precautionary approach to the assessment that has been adopted identifies 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-001-004 to EC-004-004 and Volume 5: Maps EC-01 to EC-12. Statutory and non-statutory designated sites are shown on Volume 5: Maps EC-01-068b to EC-01-070.
- 7.3.2 Land required for the construction of the Proposed Scheme and that adjacent to it consists mainly of buildings and hard standing, with other habitats limited to grassland and hedgerows in close proximity to a linear watercourse, railway and road corridors. Both the Grand Union Canal and the Digbeth Branch Canals sustain populations and assemblages and provide corridors for the movement of wildlife within this area, as do the Rivers Rea and Tame and the Birmingham and Derby line. There are also small isolated blocks of abandoned industrial land that comprises bare ground and scattered vegetation, including the area of land identified for the proposed Washwood Heath depot, and areas of residential gardens.

Designated sites

- 7.3.3 There are no statutory designated sites located within 500m of the land required for the construction of the Proposed Scheme.
- 7.3.4 There are six SLINC relevant to the assessment in this area; each is of district/borough value. They are:
- River Tame SLINC – located partly within land required for the construction of the Proposed Scheme, near to the proposed Bromford tunnel west portal. This SLINC is notified for its watercourse habitats, which are known to support bullhead (a fish), waterbirds, bats and potentially otter as well as other species. The SLINC extends to the east into Park Hall nature reserve, in the adjacent Castle Bromwich and Bromford area (CFA25);
 - River Rea and adjoining land SLINC – approximately 0.25ha (0.7%) of this SLINC is located partially within the land required for the construction of the proposed Curzon Street No.1 and No.2 viaducts. The SLINC is of importance as

a corridor that facilitates species dispersal between isolated areas of semi-natural habitat;

- Land at Warren Road SLINC – located partially within land adjacent to the south-west side of the proposed Washwood Heath depot. The SLINC is of value for the acid grassland that it supports;
- Grand Union Canal SLINC – the route will cross the Grand Union Canal at the proposed Saltley Canal underbridge. The SLINC is notified for its function in facilitating species dispersal between isolated, semi-natural habitats and because of the wetland plants and birds it supports;
- New Saltley Pool SLINC – located adjacent to land required for the construction of the proposed Washwood Heath rail overbridge. It contains two pools, neutral grassland and wet grassland; and
- Digbeth Branch Canal SLINC – the route will cross the Digbeth Branch Canal on viaduct (Curzon Street No. 3 viaduct). The SLINC is notified for its importance as a corridor that facilitates species dispersal between isolated areas of semi-natural habitat and also because of the wetland plants and birds that it supports.

Habitats

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

Watercourses

- 7.3.6 This area includes sections of the River Tame, a tributary of the River Rea; Washwood Heath Brook; Digbeth Branch Canal; and the Grand Union Canal. The route of the Proposed Scheme traverses the Digbeth Branch Canal and the Grand Union Canal. All of these watercourses facilitate species dispersal between areas of semi-natural habitat across this urbanised part of Birmingham. The water quality of these Local Biodiversity Action Plan³⁸ (LBAP) habitats is moderate and supports a range of common and widespread species. Each watercourse is of district/borough value.

Water bodies

- 7.3.7 There are two pools at New Saltley Pool SLINC adjacent to land required for the construction of the Washwood Heath rail overbridge on the west side of the Grand Union Canal. The pools are small in size and support species that are common and widespread. The pools are collectively of district/borough value.
- 7.3.8 There are several water bodies, occupying approximately 0.7ha, which exist within the land required for the Proposed Scheme. These are concrete lined and are of local/parish value.

³⁸ The Birmingham and the Black Country Biodiversity Action plan Steering Group (2000), *Birmingham and the Black Country's Biodiversity Action Plan*.

Hedgerows

- 7.3.9 Hedgerow with at least 80% cover of native woody species is a habitat of principal importance³⁹. Approximately 190m of a species-rich hedgerow occurs within land required to construct the Proposed Scheme, with the remainder of the hedgerow (approximately 70m) outside the land required. It is located within land required for construction near the proposed B4114 Saltley viaduct (east) satellite compound on the west side of the Grand Union Canal to the south of B4114 Saltley Viaduct. A second hedgerow, approximately 100m long, is located outside the land required between the Grand Union Canal and the River Rea. These hedgerows are classified as 'Important' according to the 'Wildlife and Landscape' criteria of the Hedgerows Regulations 1997⁴⁰ and together are of district/borough value, as such hedgerows are uncommon in such heavily urbanised environments.
- 7.3.10 Short sections of species-poor hedgerow were recorded at separate locations alongside the Grand Union Canal, River Rea and Digbeth Branch Canal. Each of these hedgerows supports species that are common and widespread and are isolated from large areas of semi-natural habitat. The species-poor hedgerows are of local/parish value.

Grassland

- 7.3.11 Semi-improved acid grassland known to support wavy hair grass, exists on land at Warren Road SLINC. The acid grassland is of a limited diversity and extent and is an LBAP habitat and habitat of principal importance). The semi-improved acid grassland is of district/borough value.
- 7.3.12 A small extent of neutral grassland occurs at New Saltley Pool SLINC and adjacent to land required for the construction of the Washwood Heath rail overbridge on the west side of the Grand Union Canal. The neutral grassland is of limited diversity, and is of district/borough value.
- 7.3.13 Amenity grassland occurs in various public open spaces including road verges. The amenity grassland was found to support a low diversity of plant species which are common and widespread. It is of local/parish value.

Scattered trees

- 7.3.14 Scattered broad-leaved tree species occur within the complex of land ownerships contained within the area of land identified for the proposed Washwood Heath depot and alongside the Birmingham and Derby line, Grand Union Canal SLINC, River Rea and adjoining land SLINC and Digbeth Branch Canal SLINC. Some have been planted and others are likely to have colonised naturally. The scattered trees in this area comprise common species and this habitat type occupies a small area. Scattered broad-leaved trees in this area are of local/parish value.

³⁹ *Natural Environment and Rural Communities Act 2006 (S41)*. (2006), London, Her Majesty's Stationery Office.

⁴⁰ *The Hedgerows Regulations 1997* (SI 1997 No. 1160), London, Her Majesty's Stationery Office.

Buildings/structures

- 7.3.15 A large number of buildings (some derelict) and built structures, some of which may constitute LBAP habitats, characterise the area. Industrial and trading estates, storage and distribution depots (including railway freight) are prevalent along the eastern section of the Proposed Scheme. These buildings and structures provide habitat for a range of species. This habitat is of local/parish value.

Protected and/or notable species

- 7.3.16 A summary of the species relevant to the assessment is provided in Table 5.

Table 5: Protected and/or notable species

Species/species group	Value	Receptor	Baseline and rationale for valuation
Birds	County/ metropolitan	A breeding population of peregrine at an undisclosed site.	A Wild Birds Directive Annex 1 ⁴¹ and Wildlife and Countryside Act 1981 ⁴² Schedule 1 species which is uncommon in the West Midlands was recorded during the survey. It is located outside the area of land required for the construction of the Proposed Scheme.
	Local/parish	A breeding bird assemblage adjacent to the Grand Union Canal and the River Rea in Saltley.	An assemblage of common species were recorded at low densities during the surveys.
Bats	District/ borough	A population of common pipistrelle associated with Common Lane.	A small population of this species of principal importance was recorded foraging and dispersing in the area around Common Lane. Although one of the more common UK species, bats are typically less abundant in urban areas.
Aquatic macro-invertebrates	District/ borough	An assemblage of macro-invertebrates including the caddisfly <i>Cyrtus flavidus</i> associated with the Digbeth Branch Canal.	A diverse assemblage of macro-invertebrates was recorded including the caddisfly <i>Cyrtus flavidus</i> which is local and scarce in the West Midlands and is an indicator of good water quality.
Water Vole	Up to district/borough	Possible population(s) of water vole of the River Rea.	There was no access for survey on a stretch of the River Rea of this watercourse at a locations crossed by the Proposed Curzon Street No.1 viaduct, within land required for construction of the Proposed Scheme.
Flora	Local/ parish	A population of kidney vetch occurs within the complex of land ownerships contained	A population of a species which is uncommon in the West Midlands was

⁴¹ Council of the European Communities. (2009) *Directive 2009/147/EEC on the conservation of wild birds*.

⁴² *Wildlife and Countryside Act 1981*. (1981) London, Her Majesty's Stationery Office.

Species/species group	Value	Receptor	Baseline and rationale for valuation
		within the area of land identified for the proposed Washwood Heath depot.	recorded during the surveys within land required to construct the Proposed Scheme.
Reptiles	Up to local/parish	Possible population(s) of common reptile species on land around Nechells Gas Holders and at Warren Road SLINC.	Suitable habitat exists for common reptile species on land around Nechells Gas Holders, and at Warren Road SLINC (access for surveys was not possible) within land required to construct the Proposed Scheme.
Amphibians	Local/parish	A population of smooth newt in a pond adjacent to Watson Road, Birmingham.	A small population of smooth newt recorded during the surveys. This species is common and widespread in the West Midlands.

Future baseline

Construction (2017)

- 7.3.17 A summary of the known developments which are assumed to be built and occupied prior to construction of the Proposed Scheme is provided in Volume 5: Appendix CT-004-000.
- 7.3.18 There are a number of new developments which will be in place in advance of the Proposed Scheme, however it is not anticipated these will alter the baseline conditions reported here. It is therefore unlikely that the value of this area will change by the date at which construction commences.

Operation (2026)

- 7.3.19 There are no known committed developments or changes to management in this area that will affect the operational baseline.

7.4 Effects arising during construction

Avoidance and mitigation measures

- 7.4.1 The following measures have been included as part of the design of the Proposed Scheme and avoid or reduce impacts to features of ecological value:
- the Bromford tunnel will be constructed under the River Tame and will avoid shading impacts to plant growth and water quality at two crossing points; and
 - the use of clear span bridges has been included as part of the design of the Proposed Scheme to reduce the impact on river-based fauna and allow riparian plant habitat to remain in place. The crossings of the Grand Union Canal, River Rea and Digbeth Branch Canal have been designed, where practicable, to avoid footings within the channels and to reduce shading effects.

- 7.4.2 The assessment also assumes implementation of the measures set out within the draft CoCP (Volume 5: Appendix CT-003-000).

Assessment of impacts and effects

Designated sites

- 7.4.3 Earthworks required for the Washwood Heath depot will result in the loss of approximately 1ha of wavy hair grass dominated acid grassland at Land at Warren Road SLINC, representing 100% of the site. This will have an adverse effect on the integrity of the SLINC which is significant at the district/borough level.
- 7.4.4 No impacts are anticipated on the following five designated sites which form part of the baseline:
- River Tame SLINC;
 - River Rea and adjoining land SLINC;
 - Grand Union Canal SLINC;
 - New Saltley Pool SLINC; and
 - Digbeth Branch Canal SLINC.

Habitats

- 7.4.5 Sections of the Washwood Heath Brook and the River Rea Overflow Channel (which is also currently culverted) will be exposed to natural daylight. This will have beneficial effects on light and dissolved oxygen levels of benefit to aquatic flora and this is a beneficial effect at local/parish level.
- 7.4.6 Approximately 190m of species-rich and 'Important' hedgerow alongside the Grand Union Canal south of B4114 Saltley Viaduct will be lost. This loss of hedgerow will result in a permanent adverse effect which is significant at district/borough level.
- 7.4.7 Earthworks required for the construction of the proposed Washwood Heath depot will result in the loss of approximately 1ha of wavy hair grass dominated acid grassland at Land at Warren Road SLINC. This will result in a permanent adverse effect on the conservation status of this habitat which is significant at district/borough level.
- 7.4.8 It is considered unlikely that any other effects at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-004.

Species

- 7.4.9 It is considered unlikely that any effects on species receptors at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-004.

Other mitigation measures

- 7.4.10 This section describes additional measures designed to reduce or compensate for significant ecological effects. These include habitat creation and habitat enhancement.

- 7.4.11 Native species of tree and shrub will be planted to establish approximately 1km of species-rich hedgerows along the southern boundary of the Proposed Scheme adjacent to Saltley Business Park. Native trees and shrubs will also be planted to link isolated semi-natural habitats between the River Tame, the proposed Washwood Heath depot and the River Rea. Vegetation will be established in accordance with the ecological principles of mitigation (see Volume 5: Appendix CT-001-000/2). Collectively, this will represent the provision of more than double the length of species-rich hedgerow that will be lost and will benefit a range of species and help facilitate species dispersal across this built-up area of Birmingham. Following implementation of these measures, there will be a beneficial effect on hedgerows at local/parish level.
- 7.4.12 Approximately 1ha of acid grassland will be created using native herbs and grasses. This grassland will mainly be created on banks on the southern side of the area surrounding the proposed Washwood Heath depot. The banks will be designed to facilitate the establishment of acid grassland and to be attractive to a range of invertebrate and bird species. Following implementation of these measures, the loss of similar habitat at Land at Warren Road SLINC will not be significant.
- 7.4.13 An ecologically beneficial brown roof⁴³ will be provided on two of the buildings at the proposed Washwood Heath depot to attract a range of species that currently occur within the surrounding area including plants, insects and birds, which will enhance the biodiversity value of the site. This is a beneficial effect at local/parish level.
- 7.4.14 Consideration will be given to the incorporation of soft banks and shelves in the Washwood Heath Brook diversion and River Rea Overflow Channel diversion to facilitate the establishment of marginal vegetation, and creation of side pools to provide additional habitat for aquatic animals and plants. If implemented, these measures would have a beneficial effect on watercourses which could be significant at up to district/borough level.

Summary of likely residual significant effects

- 7.4.15 Taking into account mitigation, compensation and enhancement proposed, there are no significant adverse residual ecological effects arising from construction. If all the mitigation measures are implemented for the Washwood Heath Brook diversion and River Rea Overflow Channel diversion there would be beneficial effects.

7.5 Effects arising from operation

Avoidance and mitigation measures

- 7.5.1 The following measures have been included as part of the design of the Proposed Scheme and avoid or reduce impacts on features of ecological value:
- all culverts will be suitable to allow passage for mammals such as otter and water vole, taking into account flood events, or will have an alternative dry tunnel installed; and

⁴³ A brown roof is one which may be partially or fully covered in vegetation in order to benefit wildlife.

- all bridges will be constructed with clear spans⁴⁴, avoiding permanent structures within the channel and allowing passage of bats along the watercourse to maintain bat foraging and dispersal corridors.

Assessment of impacts and effects

- 7.5.2 The operation of the Proposed Scheme has the potential to result in a variety of impacts on bat populations including those as a result of collision with passing trains, turbulence and noise. The point at which such impacts are considered to result in a significant adverse effect on the conservation status of the population concerned will differ between species. As a consequence, the following assessment of operational impacts takes into account the differing character and nature of the bat populations and/or assemblages concerned in determining the likely effects of the Proposed Scheme on each of these receptors.
- 7.5.3 Noise, vibration and lighting from passing trains have the potential to disturb bat species foraging and commuting within habitats close to the Proposed Scheme. Understanding of the impact of noise on bats caused by passing trains is limited. There is some evidence to suggest that gleaning bats, such as brown long-eared, will have reduced foraging success within areas where there is persistent noise from busy roads. However, noise generated from passing trains will be regular but temporary and as such will differ from that resulting from a busy road.
- 7.5.4 Due to the large areas over which bats forage it is likely that any loss of, or displacement from suitable foraging habitat in the vicinity of the Proposed Scheme would in itself amount to only a small proportion of the wider available resource. However, the impact of any such disturbance or displacement could be greatly increased if bats are hampered in moving between breeding sites, hibernation sites and other roosts which they commonly utilise.
- 7.5.5 A small number of common pipistrelles were recorded commuting/foraging at Common Lane where Washwood Heath depot is proposed. The surveys did not identify any key foraging areas or dispersal routes used by this small local population of common pipistrelle that will be bisected or otherwise impacted by the Proposed Scheme. Consequently, no significant adverse effects on bats are expected in this area.
- 7.5.6 The noise made by passing trains has the potential to disturb birds within habitats close to the Proposed Scheme. Birds habituate to loud noises that they hear regularly and frequently, and hence it is considered that this will not generally cause significant effects. There is some evidence to suggest that breeding bird densities can be reduced where there is persistent noise from busy roads due to birds being unable to hear each other's songs. However, this is not expected to occur with the Proposed Scheme as trains will pass quickly. The effect of train noise on breeding birds is not considered to be significant.
- 7.5.7 It is considered unlikely that any other effects at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-004.

⁴⁴ A clear span bridge spans a watercourse without altering the watercourse bed or bank.

Other mitigation measures

- 7.5.8 No other mitigation measures during operation are required.

Summary of likely residual significant effects

- 7.5.9 Taking into account mitigation, compensation and enhancement proposed, no significant residual ecological effects are expected during operation.

8 Land quality

8.1 Introduction

- 8.1.1 This section of the report presents the baseline conditions that exist along the Proposed Scheme 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 (for example 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 environment and what needs to be done to prevent such contamination.
- 8.1.3 The main environmental features of this area include: the River Tame, River Rea, Washwood Heath Brook, Digbeth Branch Canal and Grand Union Canal and linking surface drainage and overflow channels. There are large areas of superficial sand and gravel deposits which constitute a Secondary A aquifer; and the Bromsgrove Sandstone around Birmingham city centre which constitutes a Principal aquifer. The area is characterised by densely populated residential areas and their associated community facilities.
- 8.1.4 The main land quality issues in this area include a number of land uses that are considered to have the potential to be contaminative. Of particular note are the sites within the proposed Washwood Heath depot and adjoining Bromford tunnel west portal. These sites include:
- the former Alstom works site;
 - Washwood Heath Sidings;
 - the former Wolseley/Leyland DAF Vans (LDV) motor works;
 - former brickworks, and existing Cemex UK Materials Ltd site;
 - Hanson Heidelberg Cement Group site;

- UK Mail Depot and the “Land Rear of Freight Rover Works” historical landfill site; and
- the former gas works around the Saltley area, and land within and around the planned Curzon Street station.

8.1.5 Details of baseline information and the land quality assessment methodology are outlined in the following appendices:

- Volume 5: Appendix CT-001-000/1: the SMR and Volume 5: Appendix CT-001-000/2 the SMR Addendum; and
- Volume 5: Appendix LQ-001-026.

8.1.6 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 14.

8.1.7 Engagement has been undertaken with Birmingham City Council (BCC) regarding contaminated land and mineral resources. In addition the Environment Agency and the Ministry of Defence (MOD) were contacted regarding contaminated land. The Petroleum Officer for the West Midlands Fire Service was also contacted with regards to information on bulk fuel storage sites.

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 Volume 1 and in the SMR and its addendum presented in Volume 5: Appendices CT-001-000/1 and CT-001-000/2. This section follows the standard assessment methodology.

8.2.2 Baseline data were reviewed for the area of land required to construct the Proposed Scheme together with a buffer extending out for a minimum of 250m, but in the case of groundwater data up to 1km. This is defined as the study area. The assessment that follows has not assessed new or diverted utilities that will be located within the boundaries of existing highways. These are scoped out of the assessment as although there is work below ground, it is predominantly within highway construction i.e. non-contaminative materials. These are low risk with regard to land contamination issues, and therefore unlikely to cause any significant land quality effects.

8.2.3 Familiarisation visits to the study area were made where the location of the Proposed Scheme was viewed from points of public access only. In addition, visits to key sites have been undertaken to validate the data collected. Key sites are those which are considered to have the greatest potential for contamination and are considered to be at risk of being affected by the Proposed Scheme. Not all sites identified as a priority for inspection have been visited because of land access constraints. Site visits were undertaken to confirm documentary knowledge regarding the site and the lack of complete site walkovers is considered unlikely to have substantially impacted the land quality assessment. Site visit notes are presented in Volume 5: Appendix LQ-001-026.

8.3 Environmental baseline

Existing baseline

8.3.1 Unless otherwise stated, all features described in this section are presented in Volume 5: Maps LQ-01-068b to LQ-01-070.

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 Volume 5: Map WR-02-26.

8.3.3 The study area mostly encompasses developed urban areas. There are known areas of made ground identified in the study area, which are associated with land raising as part of general development, and highway and railway earthworks in the area. Areas of particular note, which are all shown on Volume 5: Map LQ-01-069 include the Birmingham and Derby line, the former Alstom works (G7), former Wolseley/Leyland DAF Vans (LDV) factory site (centred on H9), Mount Street Business Centre (G4), Mainstream Industrial Park (D6) and Network Park industrial estate (D6 to C7).

8.3.4 Three historical landfills have been identified – the ‘Land Rear of Freight Rover Works’ landfill (Volume 5: Map LQ-01-069, I9 and J9), the former Adderley Park Brickworks landfill (Volume 5: Map LQ-01-070, centred on J9), and a former brick works that is indicated on British Geological Survey (BGS)⁴⁵ mapping to be a historical landfill between the A4540 Lawley Middleway road and Digbeth Branch Canal (Volume 5: Map LQ-01-70, G6). Further details of these are given in Table 6.

8.3.5 In addition to the landfill sites and areas identified above, other known areas of made ground are present in the following locations:

- an intermittent flood bund along the southern bank of the River Tame and general fill to the valley floor throughout the study area;
- current and historical gas works adjacent to the Birmingham and Derby line off A47 Heartlands Parkway (Volume 5: Map LQ-01-069, G5) and Saltley Road (Volume 5: Map LQ-01-069, C5, C6, D5 and D6);
- an area of infilled clay pits associated with a former 19th century brickworks on the Cemex UK Materials Limited (Volume 5: Map LQ-01-069, G6) and former Alstom Works (Volume 5: Map LQ-01-069, G7);
- an infilled reservoir (Volume 5: Map LQ-01-069, E6) beneath and south of the centre of the study area between Aston Church Road and the B4114 Saltley Viaduct;
- made ground placed west of Duddeston Mill Road (Volume 5: Map LQ-01-069, A7 and B7), when the area was redeveloped in the 1970s, located north of the centre of the study area and the River Rea;

⁴⁵ British Geological Survey; www.bgs.ac.uk; Accessed June 2013.

- made ground placed when Curzon Street Goods Station (Volume 5: Map LQ-01-070, F6 and G6) was constructed in the 1830s beneath and adjacent to the centre of the study area, south of Millennium Point; and
- Park Street Gardens (Volume 5: Map LQ-01-070, F6) and disused 19th century cemetery to the west of the study area.

8.3.6 Superficial glacial deposits form a discontinuous layer across the upper parts of the River Rea Valley and River Tame valley sides. In particular, glacial deposits are present across the area east of Aston Church Road and continue to the western limits of the study area. A notable feature is a buried glacial channel up to 30m deep and infilled with a sequence of glacial deposits. This occurs south of the former LDV factory site and continues south of Saltley Business Park up to Aston Church Road and Network Park industrial estate (Volume 5: Map LQ-01-069, G8 to C5).

8.3.7 The River Tame and River Rea valley floor is underlain by widespread deposits of alluvium and river terrace deposits. The terrace deposits have been locally excavated for sand and gravel, notably at the junction of the River Rea and River Tame valleys (Volume 5: Map LQ-01-069, I7), north of Gravelly Industrial Estate (Volume 5: Map LQ-01-069, I6).

8.3.8 The underlying solid geology comprises Mercia Mudstone Group as far west as the Birmingham Fault, which approximately follows the line of the River Rea valley (Volume 5: Map LQ-01-070, G6). Mercia Mudstone typically comprises a weak red brown silty mudstone with minor amounts of carbonate and gypsum when unweathered. The Arden Sandstone Formation occurs within the Mercia Mudstone as a thin discontinuous horizon of siltstone and sandstone, although this is much higher in the sequence, to the east of Birmingham.

8.3.9 The Bromsgrove Sandstone Formation, which is part of the Sherwood Sandstone Group, is present to the west of the Birmingham Fault across the remainder of the study area.

Groundwater

8.3.10 There are three categories of aquifer identified within the study area. The alluvium, river terrace deposits and glaciofluvial deposits are classified as Secondary A aquifers, the Mercia Mudstone is classified as a Secondary B aquifer, and the Bromsgrove Sandstone is classified as a Principal aquifer. The Arden Sandstone within the Mercia Mudstone is also classed a Secondary A aquifer.

8.3.11 Groundwater is expected to be shallow and present within the superficial deposits across this study area. The Mercia Mudstone Group is water-bearing in places by virtue of thin layers of siltstones and sandstones within the mudstone and the Arden Sandstone. Groundwater contained in these parts of the sequence is generally confined by the overlying mudstones.

8.3.12 The Environment Agency reports that there are seven licensed groundwater abstractions within 1km of the centre line of the study area. These all abstract water from the Bromsgrove Sandstone and are for industrial use with two also listed as water supply abstractions. There are three groundwater source protection zones

(SPZ) associated with abstractions at the Grand Hotel on Colmore Row (Volume 5: Map LQ-01-070, D4), the Burlington Hotel on New Street (Volume 5: Map LQ-01-070, D5), and Aston Manor where zone 1 extends to within the study area at the point that the B4132 Thimble Mill Lane crosses the Birmingham and Fazeley Canal in Aston (Volume 5: Map LQ-01-070, J2).

- 8.3.13 Further detail on groundwater abstractions and groundwater in the study area can be found in Section 13.

Surface waters

- 8.3.14 There are four key watercourses in the study area: the River Tame, the River Rea, the Grand Union Canal and Digbeth Branch Canal. The study area broadly follows the river valley. There are also several other minor watercourses, drains, overflow channels, a boating lake and ponds within the study area. The central part of the study area crosses:

- the River Tame, east of the UK Mail site (Volume 5: Map LQ-01-069, J9);
- the River Rea and Grand Union Canal, approximately 80m east of the B4114 Saltley Viaduct (Volume 5: Map LQ-01-069, D5 and D6);
- the River Rea, approximately 350m south of Duddeston Mill Road (Volume 5: Map LQ-01-069, B7);
- Washwood Heath Brook, approximately 600m east of the A4040, Bromford Lane (Volume 5: Map LQ-01-068b, B7); and
- the Digbeth Branch Canal, approximately 180m west of the A4540 Lawley Middleway (Volume 5: Map LQ-01-070, G6).

- 8.3.15 There are no licensed surface water abstractions within the study area.

- 8.3.16 Further information on surface waters in the study area can be found in Section 13 Water Resources and flood risk.

Current and historical land use

- 8.3.17 The current land use within the study area is predominantly commercial and industrial, ranging from light industrial estates, works buildings, garages, warehouses, depots, tanks, scrap yards and railway land. The following current commercial land uses, which are all shown on Volume 5: Map LQ-01-069 are of particular note:

- land between the A4040 Bromford Lane and the B4114 Saltley Viaduct incorporating the Alstom Works (G7), Washwood Heath sidings (I7), Cemex UK Materials Ltd (G6), Hanson Heidelberg Cement Group (G6), a scrap yard (F6) and UK Mail Limited (J9);
- Washwood Heath Gas Works (G5), north east of the Stechford and Aston line;
- Saltley Business Park (centred on E6) within the centre of the study area in Saltley;
- Smurfit Kappa packaging factory (D5 and E5) located north of Saltley Road;

- various industrial facilities located between the B4114 Saltley Viaduct and Erskine Street, including but not limited to Mainstream Industrial Park (D6), Vauxhall Trading Estate (C6 and B6), Network Park industrial estate (D6 to C7);
- Saltley Depot and other Network Rail facilities (C7), including the West Midlands Railway Signalling Centre in Saltley (C6 and C7); and
- Crown freight terminal (A6) and Freightliner Terminal Depot (A7 and B7) and facilities in Nechells Green.

8.3.18 Residential land use with associated educational and amenity facilities, including public parks, are present in the south, north and west of the study area.

8.3.19 Potentially contaminative historical land uses in the study area, which are predominantly shown on Volume 5: Map LQ-01-069, include:

- an area of sewage works (centred on H5) north of the current Carlsberg Brewery (H6) and Gravelly Industrial Estate (H5);
- an area of infilled clay pits located on the Cemex UK Materials Ltd (G6) and former Alstom works site (G7);
- the Metropolitan-Cammell Carriage and Wagon Company Ltd including railway sidings, later becoming the Alstom works (G7), occupying an area in the north of Washwood Heath;
- the Wolseley Motor Works, which later became the LDV factory site (centred on H9), between the current UK Mail site and Aston Church Road;
- the Saltley Works including a gasworks and widespread stockpiling and tipping off Watson Road, north of Aston Church Road (centred on F5);
- railway development including a carriage works in the north of the study area (F5) and the Saltley (Railway Carriage) Works in the south (centred on E6);
- the infilled Canal Reservoir (E5) between the current B4114 Saltley Viaduct and Aston Church Road, with other industries, such as the Nechells Chemical Works (E5), Birmingham Paper Mill and an electro plating works (E5) approximately 50m further north/north-west; and
- an extensive area of railway land terminating at the Curzon Street Goods Station (Volume 5: Map LQ-01-070, F6 and G6).

8.3.20 There are three historical landfills in the study area as detailed in Table 6. All have records of receiving industrial, commercial and household waste; as such these sites may be associated with a wide range of contaminants. In addition, these sites may be emitting landfill gases, such as carbon dioxide (CO₂), methane and volatile organic compounds (VOC).

Table 6: Landfill sites located in or within 250m of the study area

Name	Location	Description
'Land Rear of Freight Rover Works' landfill	Located in the west of the UK Mail site and north-east of the former LDV factory site at Washwood Heath, Volume 5: Map LQ-01-069, I9 and J9.	The Environment Agency records ⁴⁶ indicate that inert, commercial and household waste was deposited here up until 1950. There are indicated to be two separate areas of landfill. No ground gas data was available.
Former Adderley Park Brickworks landfill site	Located approximately 200m south-east of the Freightliner Terminal Depot, Volume 5: Map LQ-01-070, centred on J9.	The Environment Agency records indicate that inert, industrial, commercial and household waste was deposited here up until 1937. No ground gas data was available.
Landfill shown on British Geological Survey (BGS) mapping (former brickworks)	Located between the A4540 Lawley Middleway and Digbeth Branch Canal, Volume 5: Map LQ-01-070, G6.	BCC have confirmed that this area has been remediated as part of the recently developed Curzon Gateway student accommodation. No further details are currently available.

Other regulatory data

8.3.21 Regulatory data reviewed includes pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention Control (IPPC) licences). Notable data are as follows:

- two fuel station entries; one for Whittaker Fleet Care Limited in Digbeth, in the south of the study area, and one for Texaco, east of Vauxhall Road; and
- 37 recorded minor pollution incidents to controlled waters and four significant incidents have been recorded within the study area. Where specified, the significant incidents included a leaking tank and a chemical spill following a collision resulting in an impact to the River Rea and an unspecified canal.

Mining and mineral areas

8.3.22 The Mercia Mudstone was excavated within the Washwood Heath area during the 19th and early 20th centuries for brick making. In addition, the glaciofluvial deposits, river terrace deposits and the alluvial deposits have been locally excavated for sand and gravel, again mainly in the Washwood Heath area, but also within the Gravelly Industrial Estate, during the 19th and early 20th centuries.

8.3.23 Currently, there is no mineral extraction or mining activity within the study area or designations for any future mining activities. There are no mineral safeguarding areas or preferred areas of search for mining and mineral resources within the study area.

Geo-conservation resources

8.3.24 There are no geo-conservation resources identified within the study area.

⁴⁶ Environment Agency; www.environment-agency.gov.uk; Accessed: 14 June 2013.

Receptors

8.3.25 The receptors that have been identified within this study area are summarised in Table 7.

Table 7: Summary of land quality receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land Contamination	People	Residents (Drews Lane, Northleigh Road and Ingleton Road in Ward End, Bromford Drive, Bromford Road and Farnhurst Road in Bromford, north of Washwood Heath Road in Washwood Heath, north of Aston Church Road and east of Adderley Road in Saltley, south of Garrison Street in Bordesley, Hampton by Hilton hotel at Star City, north and south of Vauxhall Road, Jennens Court student accommodation, Masshouse apartments, New Canal Street, Hotel Le Tour and Bordesley Street in Birmingham city centre, Curzon Gateway student accommodation shown on Volume 5: Map LQ-01-68b to Map LQ-01-070)	High
		Schools (St Vincent's Primary School (Volume 5: Map LQ-01-70, H6), Ivecinna Academy School (Volume 5: Map LQ-01-70, H8), Adderley Primary School (Volume 5: Map LQ-01-69, B9), Adderley Nursery Centre (Volume 5: Map LQ-01-69, D8), Saint Saviour's Church of England Primary School (Volume 5: Map LQ-01-69, E7), Al Huda Girls School (Volume 5: Map LQ-01-69, E7), Little Angel's Day Nursery (Volume 5: Map LQ-01-69, G8), Leigh Junior, Infant and Nursery School (Volume 5: Map LQ-01-69, G8) and Al Birr Independent School (Volume 5: Map LQ-01-070, H5 and G5)	High
		Users of public open space (north of Vauxhall Road, Eastside City Park, Ward End Park, Garrison Lane Park, land south of River Tame shown on Volume 5: Map LQ-01-69 and Map LQ-01-070)	Moderate
		Workers (distributed throughout the study area shown on Volume 5: Map LQ-01-68b to LQ-01-070)	Moderate
		Station users (Curzon Street station)	High
	Controlled waters	Principal aquifer (Bromsgrove Sandstone)	High
		Secondary A aquifers (superficial glaciofluvial and river terrace deposits, Arden sandstone)	High
		Secondary B aquifers (Mercia Mudstone)	Low
		Rivers and Canals (River Tame, River Rea, Grand Union Canal, Digbeth Branch Canal and overflow channels shown on Volume 5: Map LQ-01-68b to LQ-01-70)	Moderate
	Built environment	Buildings and property	Low
		Underground structures and services	Low

Future baseline

Construction (2017)

8.3.26 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. The potential for the baseline to change in the lead up to the construction of the Proposed Scheme is limited to the extent to which any new development necessitates remediation or mitigation measures to control potential contamination releases. Any new development in the study area on potentially contaminated land will need to be suitable for its intended use as set out in the National Planning Policy Framework⁴⁷ (NPPF). To meet this requirement new development sites may require remediation to be undertaken. This will mean that some areas described as having potentially contaminative current and/or historical land use, may no longer be of significance at the time of construction of the Proposed Scheme. Known committed developments where this might apply include:

- a mixed use development 'student hub' including formal teaching areas as part of the Birmingham City University Campus at land bounded by Gopsal Street, Cardigan Street, Curzon Street and Digbeth Branch Canal within the Eastside area of the city (2012/04578/PA);
- the redevelopment of Eastside Locks comprising mixed use development including 475 residential units (2008/02942/PA);
- Beorma Quarter development including refurbishment of existing buildings and construction of new buildings for a mixed commercial and leisure development (2009/00295/PA and 2012/02104/PA);
- a mixed use development including residential with 353 flats at Bordesley Street, Typhoo Wharf in Digbeth (2007/01816/PA); and
- a mixed use development comprising four buildings at Masshouse (Plot 7) on land bounded by Dale End, Chapel Street, Moor Street Queensway and Priory Queensway (2007/01816/PA).

8.3.27 The potential for the baseline to change will also depend on whether any land has been classified as contaminated land by the Local Authority under Part IIA of the Environmental Protection Act 1990⁴⁸ (hereafter referred to as 'Part 11A'). A number of mechanisms drive these determinations therefore they are difficult to predict. Where Part IIA determinations are made, the potential baseline change will occur where remediation works are subsequently undertaken.

8.3.28 Based on the above, the land quality assessment does not consider these possible future changes to the baseline.

Operation (2026)

8.3.29 The potential for the baseline to have changed by the time the Proposed Scheme is operational is limited to the extent to which any new development (between 2017 and

⁴⁷ Communities and Local Government, (2012), *National Planning Policy Framework*. London. Her Majesty's Stationary Office.

⁴⁸ Environmental Protection Act, 1990. (c.43) London, Her Majesty's Stationary Office.

2026) necessitates remediation or mitigation measures to control potential contamination. No committed developments have been identified in this local area that will materially alter the baseline conditions in 2026 for land quality.

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 (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, run-off, 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 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 or degradation of soils (draft CoCP, Section 7); and
 - methods to manage flood risk and other extreme weather events which may affect land quality during construction (draft CoCP, Section 16).
- 8.4.2 The draft CoCP requires that prior to and during construction a programme of further investigations, which may include both desk based and site based work, will take place 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)⁴⁹; and
- British Standard BS10175 Investigation of Potentially Contaminated Sites (2011)⁵⁰.

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's UK publication, "A framework for assessing the sustainability of soil and groundwater remediation" (2010)⁵¹. 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 reused 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 reuse) or to an appropriately permitted landfill site.

Assessment of impacts and effects

8.4.5 Construction of the Proposed Scheme, including the Bromford tunnel, Washwood Heath depot and Curzon Street station, will require earthworks, utility diversions, deep foundations, tunnelling, temporary dewatering, watercourse diversions and other activities. Whilst tunnelling will generate a significant amount of excavated material, this will be predominantly natural Mercia Mudstone recovered from depth, with a very low potential for contamination. The potential for tunnelling activities to encounter contamination will be greatest at the tunnel portal, where the western approach will be in cutting through an area of historical landfill ('Land Rear of Freight Rover Works'). Earthworks within known areas of contaminated land will be required to construct the Washwood Heath depot.

8.4.6 The Curzon Street station compound and the Bromford tunnel west portal (east) compound will be two main construction compounds in this area. There will also be 11 satellite site compounds. These compounds will include maintenance facilities for plant and machinery and fuel storage in bunded tanks.

Land contamination

8.4.7 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 might pose contaminative risks for the Proposed Scheme. In total, 542 sites were considered

⁴⁹ Environment Agency, (2004), *CLR11 Model Procedures for the Management of Land Contamination*.

⁵⁰ British Standard, (2011), *BS10175 Investigation of Potentially Contaminated Sites*.

⁵¹ Sustainable Remediation Forum UK, (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*.

during the screening process; 156 of these were taken forward to more detailed risk assessments (Stages C and D). The types of sites identified for further assessment include a former gas works, sewage works, railway depots, heavy industrial sites and historical landfill. All sites assessed are shown in Volume 5: Maps LQ-01-068b to LQ-01-070.

8.4.8 Conceptual site models (CSM) have been produced for the 156 sites taken through to the Stage C and D assessments. The detailed CSM are provided in Volume 5: Appendix LQ-001-026, Section 3 and the results of the baseline risk assessments are summarised in this section. The following factors have determined the need for Stage C and D assessments:

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

8.4.9 Sites with potentially contaminative land uses have been grouped, and assessed together, where appropriate. Further detail on the basis for the CSM groups is presented in Volume 5: Appendix LQ-001-026. The groups are defined as follows:

- CSM Group A: sites within the land required to construct the Proposed Scheme, potentially containing soil/groundwater contamination and ground gas;
- CSM Group B: sites within the land required to construct the Proposed Scheme, potentially containing soil/groundwater contamination only;
- CSM Group C: sites that fall outside of the land required to construct the Proposed Scheme, potentially containing soil/groundwater contamination and ground gas; and
- CSM Group D: sites that fall outside of the land required to construct the Proposed Scheme, potentially containing soil/groundwater contamination only.

8.4.10 A summary of the baseline CSM is provided in Table 8. 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 is available, it is based on precautionary, worst case assumptions and may therefore report a higher risk than that which actually exists.

Table 8: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area reference ¹	Area name ³	Main potential impacts	Main baseline risk ⁴
26-6, 26-7, 26-11, 26-12, 26-22, 26-34, 26-35, 26-36, 26-45, 26-63, 26-65, 26-66, 26-72, 26-74, 26-75, 26-77, 26-161, 26-162 and 26-230 shown on Volume 5: Map LQ-01-068b to Map LQ-01-70 (CSM Group A sites ²)	Key sites include: historic gas works, infilled pits, worked/disturbed ground, infilled reservoir, refuse heaps, “Land Rear of Freight Rover Works” landfill, Metropolitan-Cammell Carriage and Wagon works/Alstom works, Wolseley Motor Works/LDV factory site, magnet works (including tanks) oil depot, areas of tanks/bulk storage facilities and various other general engineering works/depots. Current various class 1 and 2 units/uses including UK Mail, railway land/depot, undeveloped land, Hanson Traction, garages, Cemex UK Materials Limited, Saltley Business Park, roads, gas works, waste heaps and public open space.	Potential impact on human health on-site ⁵² (long-term)	Moderate/low
		Potential impact on human health adjacent to the site (long-term)	Low
		Potential impact on groundwater quality	Moderate/low
		Potential impact on surface water quality	Moderate/low
		Property receptors – buildings, foundations, and services	Moderate/low
26-1, 26-42, 26-44, 26-53, 26-61, 26-62, 26-73, 26-79, 26-83, 26-92, 26-108, 26-130, 26-131, 26-132, 26-133, 26-134, 26-135, 26-136, 26-160, 26-172, 26-173, 26-182, 26-194, 26-195, 26-196, 26-197, 26-198, 26-199, 26-200, 26-214, 26-215, 26-216, 26-217, 26-218, 26-219, 26-220, 26-226, 26-228, 26-231, 26-232, 26-235, 26-236, 26-238, 26-252, 26-254, 26-257, 26-258, 26-285, 26-314, 26-316, 26-317, 26-318, 26-319, 26-320, 26-327, 26-328, 26-329, 26-344, 26-345, 26-362, 26-363, 26-364, 26-369, 26-374, 26-377, 26-380 and 26-389 shown on Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Group B sites ²)	Key site include: historical works (including metal and printing), sewage works, gas works, various class 1 and 2 units/uses, Saltley Works (railway carriage and wagon), gasometers/tanks, oil tanks/petrol depot, Lawley Street Goods Station, areas of tanks/bulk storage, petrol depot, saw mill, oil depot, scrapyards, railway land use and other general engineering works/depots. Current various class 1 and 2 units/uses, undeveloped land/public open space, roads/car parks, hotel, hostel, scrap/demolition yards, Freightliner Terminal Depot, ironworks, printers, areas of tanks/bulk storage facilities, cemetery, railway land use (including Moor Street station), commercial, retail, offices and residential land use.	Potential impact on human health on-site (long-term)	Moderate/low
		Potential impact on human health adjacent to the site (long-term)	Low
		Potential impact on groundwater quality	Moderate/low
		Potential impact on surface water quality	Moderate/low

⁵² For CSM groups A and B, on-site means within the potential contaminated site identified under the “Area reference” column.

Area reference ¹	Area name ³	Main potential impacts	Main baseline risk ⁴
26-4, 26-13, 26-14, 26-18, 26-20, 26-31, 26-33, 26-46, 26-47, 26-50, 26-71, 26-82, 26-87, 26-139 and 26-229 shown on Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Group C sites ²)	Key sites include: historical mill pond (assumed infilled), mill, reservoir ponds, disturbed ground, quarry, pits, refuse heaps (assumed infilled/levelled), infilled ground, gas works, tar and chemical works, various works, brass/steel foundries, printing factories, oil depot, cemetery and other general engineering works/deposits. Current various class 1 and 2 units/uses, residential, allotments, Carlsberg Tetley Brewing Limited, public open space, waste storage/scrap metal recycling facility, Smurfit Kappa including tanks/bulk storage facilities, and Millennium Point.	Potential impact on human health on-site (long-term)	Moderate/low
		Potential impact on human health adjacent to the site (long-term)	Low
		Potential impact on groundwater quality	Moderate/low
		Potential impact on surface water quality	Moderate/low
		Property receptors – buildings, foundations, and services	Moderate/low
26-10, 26-17, 26-19, 26-28, 26-29, 26-38, 26-40, 26-43, 26-54, 26-58, 26-60, 26-64, 26-78, 26-88, 26-90, 26-109, 26-126, 26-127, 26-128, 26-129, 26-142, 26-151, 26-203, 26-205, 26-247, 26-248, 26-249, 26-259, 26-265, 26-268, 26-304, 26-321, 26-322, 26-323, 26-326, 26-330, 26-334, 26-337, 26-338, 26-340, 26-341, 26-342, 26-346, 26-347, 26-349, 26-350, 26-365, 26-367, 26-373, 26-375, 26-378, 26-381, 26-385, 26-391 and 26-405 shown on Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Group D sites ²)	Key sites include: historical sewage works, power station (including tank), various works (including electricity, paint and varnish, metal, printing, and chemical), Nechells Power Station, gas works, class 1 and 2 units/uses, Saltley Works (railway carriage and wagon), mills, cavalry/artillery barracks, areas of tanks/bulk storage facilities, railway land use and other general engineering works/deposits. Current vehicle refuelling stations, Birmingham Autogas, various class 1 and 2 units/uses, coatings manufacturers, various printers, residential, Hawkeswood Metal Recycling Limited, BVH Waste Transfer Site, car park and electricity substation, Birmingham Proof House, railway land use, National Grid storage yard, commercial, retail, offices, roads and undeveloped land.	Potential impact on human health on-site (long-term)	Moderate/low
		Potential impact on human health adjacent to the site (long-term)	Low
		Potential impact on groundwater quality	Moderate/low
		Potential impact on surface water quality	Moderate/low

Area reference ¹	Area name ³	Main potential impacts	Main baseline risk ⁴
26-11, 26-12, 26-18, 26-22 and 26-36 (within land required to construct the Proposed Scheme)	Key sites include: historical railway land use, various class 2 units/uses, gravel pits/refuse heaps/mill pond (assumed infilled/levelled), "Land Rear of Freight Rover Works" landfill, Metropolitan-Cammell Carriage and Wagon works/Alstom works, Wolseley Motor Works/LDV factory, brickworks, infilled ground, areas of tanks/bulk storage facilities, mounds/pits (assumed levelled/infilled), disturbed/worked ground and gas works.	Potential impact on human health on-site (long-term)	Moderate/low
		Potential impact on human health adjacent to the site (long-term)	Low
26-1, 26-6, 26-7, 26-10, 26-13, 26-14, 26-29, 26-35, 26-45 and 26-53 (outside of land required to construct the Proposed Scheme)		Potential impact on groundwater quality	Moderate/low to moderate
		Potential impact on surface water quality	Moderate/low to moderate
Volume 5: Map LQ-01-69 (Site Specific CSM: Washwood Heath depot and Bromford tunnel west portal/ approach)		Property receptors – buildings, foundations, and services	Moderate/low

¹ Each area is assigned a unique identification number (See Volume 5, Appendix LQ-001-026).

² CSM have been prepared as part of the detailed land contamination methodology (refer to Volume 5: Appendix LQ-001-026) for baseline, construction and post-construction.

³ Class 1, 2 or 3 assigned to a potentially contaminative land use.

⁴ The moderate risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported moderate existing baseline risk in the absence of site investigations a precautionary, worst risk is reported in the table.

Temporary effects

8.4.11 An assessment of the effects of contamination has been undertaken by comparing the CSM developed for potential contaminated sites at baseline, construction and post-construction stages. The baseline and construction CSM have been compared to determine the change in level or risk at 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 remain as high. This will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

8.4.12 Table 9 presents the summary of the resulting construction effects. The details of these comparisons are presented in Volume 5: Appendix LQ-001-026.

Table 9: Summary of potential temporary (construction) land quality effects

Area reference	Main baseline risk	Main construction risk ¹	Temporary effect – significant? (Yes/No)
26-6, 26-7, 26-11, 26-12, 26-22, 26-34, 26-35, 26-36, 26-45, 26-63, 26-65, 26-66, 26-72, 26-74, 26-75, 26-77, 26-161, 26-162 and 26-230 shown in Volume 5:	Potential impact on human health on-site (long-term) – moderate/low risk	Not applicable as receptor no longer present due to land required to construct the Proposed Scheme	N/A (N)
	Potential impact on human health adjacent to the site (long-term) – low risk	Low risk to moderate/low risk	Negligible to minor adverse (N)

Area reference	Main baseline risk	Main construction risk ¹	Temporary effect – significant? (Yes/No)
Map LQ-01-068b to Map LQ-01-70 (CSM Group A sites)	Potential impact on groundwater quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
	Potential impact on surface water quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
	Property Receptors – buildings, foundations, and services – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
26-1, 26-42, 26-44, 26-53, 26-61, 26-62, 26-73, 26-79, 26-83, 26-92, 26-108, 26-130, 26-131, 26-132, 26-133, 26-134, 26-135, 26-136, 26-160, 26-172, 26-173, 26-182, 26-194, 26-195, 26-196, 26-197, 26-198, 26-199, 26-200, 26-214, 26-215, 26-216, 26-217, 26-218, 26-219, 26-220, 26-226, 26-228, 26-231, 26-232, 26-235, 26-236, 26-238, 26-252, 26-254, 26-257, 26-258, 26-285, 26-314, 26-316, 26-317, 26-318, 26-319, 26-320, 26-327, 26-328, 26-329, 26-344, 26-345, 26-362, 26-363, 26-364, 26-369, 26-374, 26-377, 26-380 and 26-389 shown in Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Group B sites)	Potential impact on human health on-site (long-term) – moderate/low risk	Not applicable as receptor no longer present due to land required to construct the Proposed Scheme	N/A (N)
	Potential impact on human health adjacent to the site (long-term) – low risk	Low risk	Negligible (N)
	Potential impact on groundwater quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
	Potential impact on surface water quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
26-4, 26-13, 26-14, 26-18, 26-20, 26-31, 26-33, 26-46, 26-47, 26-50, 26-71, 26-82, 26-87, 26-139 and 26-229 shown in Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Group C sites)	Potential impact on human health on-site (long-term) – moderate/low risk	Moderate/low risk	Negligible to minor adverse (N)
	Potential impact on human health adjacent to the site (long-term) – low risk	Low risk to moderate/low risk	Negligible to minor adverse (N)
	Potential impact on groundwater quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
	Potential impact on surface water quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
	Potential impact on property receptors – buildings, foundations, and services – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
26-10, 26-17, 26-19, 26-28, 26-29, 26-38, 26-40, 26-43, 26-54, 26-58, 26-60, 26-64, 26-78, 26-88, 26-90, 26-109, 26-126,	Potential impact on human health on-site (long-term) – moderate/low risk	Moderate/low risk	Negligible (N)
	Potential impact on human health adjacent to the site (long-term) – low risk	Low risk	Negligible (N)

Area reference	Main baseline risk	Main construction risk ¹	Temporary effect – significant? (Yes/No)
26-127, 26-128, 26-129, 26-142, 26-151, 26-203, 26-205, 26-247, 26-248, 26-249, 26-259, 26-265, 26-268, 26-304, 26-321, 26-322, 26-323, 26-326, 26-330, 26-334, 26-337, 26-338, 26-340, 26-341, 26-342, 26-346, 26-347, 26-349, 26-350, 26-365, 26-367, 26-373, 26-375, 26-378, 26-381, 26-385, 26-391 and 26-405 shown in Volumes: Map LQ-01-068b to Map LQ-01-070 (CSM Group D sites)	Potential impact on groundwater quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
	Potential impact on surface water quality – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)
26-11, 26-12, 26-18, 26-22 and 26-36 (within land required to construct the Proposed Scheme)	Potential impact on human health on-site (long-term) – moderate/low risk	Not applicable as receptor no longer present due to land required to construct the Proposed Scheme	Not applicable (N)
26-1, 26-6, 26-7, 26-10, 26-13, 26-14, 26-29, 26-35, 26-45 and 26-53 (outside of land required to construct the Proposed Scheme)	Potential impact on human health adjacent to the site (long-term) – low risk	Low risk to moderate/low risk	Negligible to minor adverse (N)
	Potential impact on groundwater quality – moderate/low risk to moderate risk	Moderate/low risk to moderate risk	Negligible (N)
	Potential impact on surface water quality – moderate/low risk to moderate risk	Moderate/low risk to moderate risk	Negligible (N)
Volume 5: Map LQ-01-69 (Site Specific CSM: Washwood Heath depot and Bromford tunnel west portal/ approach)	Property receptors – buildings, foundations, and services – moderate/low risk	Moderate/low risk to moderate risk	Negligible to minor adverse (N)

¹The 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.

8.4.13 Table 9 indicates that based upon the assessment, no significant effects have been identified during the construction phase in relation to potential land contamination.

8.4.14 The Proposed Scheme requires the construction of a purpose built depot; the Washwood Heath depot, and the Bromford tunnel west portal. There will be substantial earthworks undertaken in this area. The land required for the proposed depot, portal and railway will include the former Alstom works site, the Washwood Heath Sidings, Cemex UK Materials Limited, Hansen Heidelberg Cement Group, the former Wolseley/LDV factory site and brickworks site, and the historical landfill sites on the UK Mail Depot and former LDV factory site. Consideration will be given as to how construction might interfere with any ground gas flow or existing venting and gas control arrangements for residual landfill material surrounding the portal site.

- 8.4.15 The proposed Bromford tunnel west portal will be located on the UK Mail site, at the eastern end of the Washwood Heath retained cut which will cut into known historical landfills and potentially contaminated ground on and adjacent to the site. The affected sites are in close proximity to the River Tame and are above a Secondary A aquifer and known buried water channels. Uncontrolled contaminant release into these has the potential to impact on water quality in the area. Whilst tunnel construction will generate a significant amount of excavated material, this will be predominantly natural Mercia Mudstone recovered from depth with a very low potential for contamination. The potential for the tunnel to encounter contamination will be greatest at the tunnel portal where the approach will be in retained cutting.
- 8.4.16 The historical gasworks of the Saltley area have potential for residual soil and groundwater contamination issues in areas not targeted by past remediation. Earthworks in these areas could have the potential to impact on water quality in the area due to sensitive receptors including the River Rea and Grand Union Canal, and the underlying Secondary A aquifer. The replacement B4114 Saltley viaduct and route will be constructed partially within these areas.
- 8.4.17 At the proposed Curzon Street station site there are numerous potentially contaminated sites in and around this area relating to historical activities associated with the rail network and small-scale industry. Deep piled foundations will be required for Curzon Street station and the Curzon Street No. 3 viaduct, which will have the potential to impact upon the underlying Principal aquifer by creating (if uncontrolled) a pathway for contaminants to enter the groundwater environment.
- 8.4.18 The Curzon Street station main compound and the Bromford tunnel west portal (east) main compound will include the storage of potentially hazardous substances, such as fuels and lubricating oils. The main and satellite construction compounds may also be used for temporary storage of potentially contaminated soils. The measures outlined in the draft CoCP will manage risks from the potentially hazardous substances stored at the construction compounds.
- 8.4.19 There are not expected to be any significant temporary cumulative effects.
- Permanent effects*
- 8.4.20 Baseline and post-construction CSM have been compared to assess the permanent (post-construction) effects.
- 8.4.21 Table 10 includes the summary of the permanent effects obtained from a comparison of the baseline and permanent CSM, and whether these are significant. The details of these comparisons are presented in Volume 5: Appendix LQ-001-026.

Table 10: Summary of permanent (post-construction) effects

Site reference	Main baseline risk	Main post-construction risk	Post-construction effect – significant? (Y/N)
26-6, 26-7, 26-11, 26-12, 26-22, 26-34, 26-35, 26-36, 26-45, 26-63, 26-65, 26-66, 26-72, 26-74, 26-75, 26-77, 26-161, 26-162 and 26-230 shown in Volume 5: Map LQ-01-068b to Map LQ-01-70 (CSM Group A sites)	Potential impact on human health on-site (long-term) – moderate/low risk	Very low risk to low risk	Negligible to moderate beneficial (Y)
	Potential impact on human health adjacent to the site (long-term) – low risk	Very low risk to low risk	Negligible to minor beneficial (N)
	Potential impact on groundwater quality – moderate/low risk	Very low risk to low risk	Minor to moderate beneficial (Y)
	Potential impact on surface water quality – moderate/low risk	Very low risk to low risk	Minor to moderate beneficial (Y)
	Property receptors – buildings, foundations, and services – moderate/low risk	Very low risk to low risk	Minor to moderate beneficial (Y)
26-1, 26-42, 26-44, 26-53, 26-61, 26-62, 26-73, 26-79, 26-83, 26-92, 26-108, 26-130, 26-131, 26-132, 26-133, 26-134, 26-135, 26-136, 26-160, 26-172, 26-173, 26-182, 26-194, 26-195, 26-196, 26-197, 26-198, 26-199, 26-200, 26-214, 26-215, 26-216, 26-217, 26-218, 26-219, 26-220, 26-226, 26-228, 26-231, 26-232, 26-235, 26-236, 26-238, 26-252, 26-254, 26-257, 26-258, 26-285, 26-314, 26-316, 26-317, 26-318, 26-319, 26-320, 26-327, 26-328, 26-329, 26-344, 26-345, 26-362, 26-363, 26-364, 26-369, 26-374, 26-377, 26-380 and 26-389 shown in Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Group B sites)	Potential impact on human health on-site (long-term) – moderate/low risk	Very low risk to low risk	Negligible to moderate beneficial (Y)
	Potential impact on human health adjacent to the site (long-term) – low risk	Very low risk to low risk	Negligible to minor beneficial (N)
	Potential impact on groundwater quality – moderate/low risk	Very low risk to low risk	Minor to moderate beneficial (Y)
	Potential impact on surface water quality – moderate/low risk	Very low risk to low risk	Minor to moderate beneficial (Y)
26-4, 26-13, 26-14, 26-18, 26-20, 26-31, 26-33, 26-46, 26-47, 26-50, 26-71, 26-82, 26-87, 26-139 and 26-229 shown in Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Group C sites)	Potential impact on human health on-site (long-term) – moderate/low risk	Moderate/low risk	Negligible (N)
	Potential impact on human health adjacent to the site (long-term) – low risk	Low risk	Negligible (N)
	Potential impact on groundwater quality – moderate/low risk	Moderate/low risk	Negligible (N)
	Potential impact on surface water quality – moderate/low risk	Moderate/low risk	Negligible (N)
	Property receptors – buildings, foundations, and services –	Moderate/low risk	Negligible (N)

Site reference	Main baseline risk	Main post-construction risk	Post-construction effect – significant? (Y/N)
	moderate/low risk		
26-10, 26-17, 26-19, 26-28, 26-29, 26-38, 26-40, 26-43, 26-54, 26-58, 26-60, 26-64, 26-78, 26-88, 26-90, 26-109, 26-126, 26-127, 26-128, 26-129, 26-142, 26-151, 26-203, 26-205, 26-247, 26-248, 26-249, 26-259, 26-265, 26-268, 26-304, 26-321, 26-322, 26-323, 26-326, 26-330, 26-334, 26-337, 26-338, 26-340, 26-341, 26-342, 26-346, 26-347, 26-349, 26-350, 26-365, 26-367, 26-373, 26-375, 26-378, 26-381, 26-385, 26-391 and 26-405 shown in Volume 5: Map LQ-01-068b to Map LQ-01-070 (CSM Ground D sites)	Potential impact on human health on-site (long-term) – moderate/low risk	Moderate/low risk	Negligible (N)
	Potential impact on human health adjacent to the site (long-term) – low risk	Low risk	Negligible (N)
	Potential impact on groundwater quality – moderate/low risk	Moderate/low risk	Negligible (N)
	Potential impact on surface water quality – moderate/low risk	Moderate/low risk	Negligible (N)
26-11, 26-12, 26-18, 26-22 and 26-36 (within land required to construct the Proposed Scheme)	Potential impact on human health on-site (long-term) – moderate/low risk	Very low risk to low risk	Negligible to minor beneficial (N)
26-1, 26-6, 26-7, 26-10, 26-13, 26-14, 26-29, 26-35, 26-45 and 26-53 (outside of land required to construct the Proposed Scheme)	Potential impact on human health adjacent to the site (long-term) – low risk	Very low risk to low risk	Negligible to minor beneficial (N)
Volume 5: Map LQ-01-69 (Site Specific CSM: Washwood Heath depot and Bromford tunnel west portal/approach)	Potential impact on groundwater quality – moderate/low risk to moderate risk	Very low risk to low risk	Minor to moderate beneficial (Y)
	Potential impact on surface water quality – moderate/low risk to moderate risk	Very low risk to low risk	Minor to moderate beneficial (Y)
	Property receptors – buildings, foundations, and services – moderate/low risk	Very low risk to low risk	Minor to moderate beneficial (Y)

- 8.4.22 The magnitude of the permanent effects and their significance have 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 as high. This will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.
- 8.4.23 Table 10 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. The residual risks will not be caused by the Proposed Scheme.
- 8.4.24 Table 10 indicates that where remediation is carried out on sites identified within the land required to construct the Proposed Scheme (CSM Group A and B, the Washwood

Heath depot CSM), there will in most instances be overall minor to moderate beneficial effects. Where potentially contaminated sites have been identified outside of the land required to construct the Proposed Scheme (CSM Group C and D, the Washwood Heath depot CSM) these will not be targeted specifically for remediation. Therefore the residual post-construction effect on these sites is expected to be negligible.

8.4.25 Depending on the type of remediation undertaken the beneficial effect for the landfill sites is most likely to be an improvement in groundwater quality or the severance of a gas migration pathway. The route will cut into the 'Land Rear of Freight Rover Works' landfill on the approach to the Bromford tunnel west portal. Consequently, earthworks will be likely to include excavation and remediation of landfill material during construction and possibly installation of gas and/or leachate control systems to prevent ingress of gas and leachate affecting the Proposed Scheme and to control migration pathways external to the construction works where such pathways may have been affected by construction.

8.4.26 Additional site-specific remediation measures will be developed at the detailed design stage if required. These measures will ensure that risks to people and property from gas and vapours in the ground, the principal risk in this area, will be controlled to an acceptable level.

Mining/mineral sites

8.4.27 There are no mining or mineral sites identified within the study area or designations for any future mining activities.

Geo-conservation sites

8.4.28 There are no geo-conservation resources identified within the study area.

Permanent effects

8.4.29 Once the Proposed Scheme is operational, any exposures created during construction will not be available for viewing and may be concealed by retaining structures or landscaping and planting.

Other mitigation measures

8.4.30 Mitigation measures will be required to control piling activities during the construction of Curzon Street station, to avoid the creation of pathways that could introduce near surface contamination to deeper groundwater resources within the principal aquifer. A piling works risk assessment will be prepared at the detailed design stage, which will inform the extent of mitigation and monitoring required.

8.4.31 In addition to the excavation and treatment of contaminated soils, it may also be necessary to install gas and leachate control systems within affected old landfill sites such as the 'Land Rear of Freight Rover Works' landfill in Washwood Heath, on a temporary or permanent basis, in order to ensure that gas and leachate migration pathways are controlled and do not adversely affect the Proposed Scheme or the wider environment, as a consequence of the Proposed Scheme. This will be determined at the detailed design stage for each specific site remediation proposal.

Summary of likely significant residual effects

- 8.4.32 No likely significant residual adverse effects are anticipated with the application of the mitigation measures set out.
- 8.4.33 Potentially contaminated sites such as those within the footprint of the Washwood Heath depot including the 'Land Rear of Freight Rover Works' historical landfill site and the former LDV factory site, which are within the land required to construct the Proposed Scheme, will be remediated during construction and will result in a permanent minor to moderate beneficial effect.

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.
- 8.5.2 A more detailed description of the Washwood Heath depot can be found in Section 2.3 Description of the Proposed Scheme.

Avoidance and mitigation measures

- 8.5.3 Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and good practice; where appropriate spillage and pollution response procedures will be established.

Assessment of impacts and effects

- 8.5.4 The critical receptor for the operational period will be maintenance workers, and as such, this is a receptor shown in the assessments.
- 8.5.5 The Washwood Heath depot is proposed within this area. Potentially hazardous materials will be stored at the depot associated with maintenance and cleaning activities. It is anticipated that the following potentially hazardous materials will be stored at the Washwood Heath depot:
- fuel oils;
 - cleaning fluids, including detergents for carriage washing;
 - metals, including swarf from wheel turning;
 - lubricating and hydraulic oils;
 - solvent and degreasers; and
 - sewage (prior to discharge to foul sewer).
- 8.5.6 In the event of any uncontrolled release of such materials, either from storage areas or during handling, contamination of the ground may occur. The magnitude of impact will depend on the type of material released, as well as the quantity and timing of the release and the sensitivity of the receiving environment. The nearest receptors to the depot will be site workers, the underlying Secondary A aquifer and the River Tame. The greatest potential impacts will arise from large scale, uncontained releases of materials with a high toxicity and resistance to degradation. The likelihood of this

impact arising will however be minimised through the adoption of the spillage and pollution response measures mentioned previously.

- 8.5.7 There are two auto-transformer stations; one located near to and north of the entrance of the Bromford tunnel west portal, within the Washwood Heath depot, and one situated north of the route at the eastern end of Curzon Street. An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leaks of coolants. However, the proposed auto-transformer stations, in common with other modern substations, will use secondary containment appropriate to the level of risk. No auto-transformer feeder stations or mid-point auto-transformer stations are proposed to be located along the route in this study area.
- 8.5.8 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.
- 8.5.9 It is unlikely that there will be any cumulative effects on land quality receptors because of the environmental controls that will be placed on operational procedures.

Other mitigation measures

- 8.5.10 There may be ongoing monitoring requirements following remediation works carried out during construction. Such monitoring could extend into the operational phase of the Proposed Scheme for example, monitoring of groundwater quality or ground gas.

Summary of likely significant residual effects

- 8.5.11 No likely significant residual effects are anticipated during 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 summarising 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 (LCAs) 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 presence of construction plant, construction compounds, construction lighting and site offices;
 - permanent effects to LCAs and visual receptors during construction arising from the demolition of existing buildings and structures, removal of existing vegetation and the introduction of new built forms, highway modifications and ground works within the land required for the Proposed Scheme; and
 - permanent landscape and visual effects during operation of the Proposed Scheme arising from the introduction of new viaducts including Curzon Street No.1, 2 and 3 viaducts, the large scale built development at the proposed Washwood Heath depot and the proposed Curzon Street station.
- 9.1.4 A separate but related assessment of effects on the setting of heritage assets is included in Cultural heritage (Section 6). Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in Volume 5: Appendix LV-001-026, which comprises the following:
- Part 1 Engagement with technical stakeholders;
 - Part 2 Environmental baseline reports;
 - 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 have been discussed with Birmingham City Council (BCC). Summer field surveys, including photographic studies of LCAs and visual assessment of viewpoints, were undertaken from May to July 2012 and during June 2013. Winter surveys were undertaken from December 2012 to February 2013.

9.2 Scope, assumptions and limitations

- 9.2.1 The assessment scope, key assumptions and limitations for the landscape and visual assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-0001-000/1) and SMR Addendum (Volume 5: Appendix CT-0001-000/2). 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 Volume 5: Maps LV-07-100b to LV-07-102 and LV-08-100b to LV-08-102. The ZTV has been produced in line with the methodology described in the SMR Addendum (Volume 5: Appendix CT-001-000/2), and is an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover will mean the actual visibility is substantially less than that shown in the ZTV. Tall construction plant (e.g. cranes and piling rigs) are excluded from the ZTV for the construction phase and overhead line equipment is excluded from the ZTV for the operational phase, but these are described and taken in to account in the assessment of effects on landscape character areas and visual receptors.
- 9.2.3 LCAs and visual receptors within approximately 1km of the Proposed Scheme have been assessed. Long distance views of up to 2km have been considered at some locations such as the edge of Aston Park.

Assumptions

- 9.2.4 The assessment has been carried out on the basis that the station and surrounding public realm will be subject to a high quality architectural and landscape design.

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, professional judgement has been used to approximate the likely views from these locations.

9.3 Environmental baseline

Existing baseline

Landscape baseline

- 9.3.1 The area is located within the valley of the Rivers Rea and Tame, which flows predominantly west to east. The limits of the valley are defined by a ridgeline approximately 1.25km north of the M6 corridor, with its southern extent marked by a similar rising landform approximately 1.45km south of the Proposed Scheme. The majority of land use in the study area comprises commercial, industrial and residential areas with parcels of open space in the form of urban parks, recreation grounds and historical parks and gardens. The M6, A38 (M) Aston Expressway, A38, A47, A41, and A45 are the primary roads in the study area. The eastern side of the city is dominated by rail, road, rivers and canal links that have historically determined land use patterns and the urban landscape.

- 9.3.2 The Proposed Scheme in this study area is located within National Character Area 97 (NCA 97): Arden, as defined by the Character of England mapping and Natural England⁵³.
- 9.3.3 Descriptions of all LCAs are provided in Volume 5: Appendix LV-001-026 Part 2. For the purposes of this assessment the study area has been sub-divided into 34 discrete LCAs, three of which are most likely to be significantly affected. A summary of these LCAs is provided below. The LCAs are shown in Volume 5: Map LV-02-100b to LV-02-102.

Washwood Heath Rail Corridor Landscape Character Area

- 9.3.4 This predominantly industrial area follows the Birmingham and Derby line from Washwood Heath in the east to meet the Digbeth Branch Canal as it approaches the city centre. Along with the Birmingham and Derby line, and its associated infrastructure and sidings, large scale warehouses are surrounded by residential areas on the valley sides to the south. Occupying the lower lying valley floor this LCA merges into a continuous industrial setting, with National Grid overhead power lines, transmission towers and chimneys (with frequent plumes). There is a high level of vacant land within the former Washwood Heath railway works and former Ward End vehicle works area. Vegetation is limited, but semi-native and ornamental shrub planting and tree cover is present around the more recent business park units and self-set shrubs and trees are common along boundaries of older industrial units and within the railway corridor. There is a mix of lighting types within the LCA. High intensity lighting, at the UK Mail depot, is very bright and a prominent night-time feature. The overall landscape condition is poor, with a low level of tranquillity and limited landscape value due to its predominantly industrial land use. Therefore, this area has a low sensitivity to change.

Digbeth, Deritend and Bordesley High Streets and Warwick Bar Conservation Areas Landscape Character Areas

- 9.3.5 Located south of the Birmingham and Derby line and north of the busy A4100 Digbeth and Deritend High Street, in central Birmingham, this predominantly industrial area is delineated by the boundaries of Digbeth, Deritend and Bordesley High Streets Conservation Area⁵⁴ and Warwick Bar Conservation Area⁵⁵. The area is also bisected by the locally listed Bordesley Viaduct carrying the elevated railway from Snow Hill and Moor Street stations in central Birmingham, running from north-west to south-east. The viaduct forms a prominent feature on the skyline in this part of the city and causes severance at ground level. The vegetated corridors of the River Rea, Grand Union Canal and Digbeth Branch Canal form a green swathe through the otherwise densely built up landscape. The overall landscape condition is fair with a relatively low level of tranquillity yet is valued at the borough level, by virtue of the conservation area designations. Therefore, this area has a medium sensitivity to change.

⁵³ Natural England, (2012), The Character of England; and Natural England National Character Area Profile 97, Arden; <http://www.naturalengland.org.uk/publications/nca/default.aspx>; Accessed: 7 February 2013.

⁵⁴ Birmingham City Council, <http://www.birmingham.gov.uk/digbethderitendca>; Accessed June 2013.

⁵⁵ Birmingham City Council, <http://www.birmingham.gov.uk/warwickbarca>; Accessed June 2013.

Eastside Landscape Character Area

- 9.3.6 Eastside LCA is a mixed character area which occupies a linear space bounded to the south by the Rugby to Birmingham line (which is on viaduct before dipping into cutting and then entering tunnel on approach to Birmingham New Street station) and to the north by the city edge. There is a mix of recent, multi-storey mixed-use development; car parks; vacant land; construction sites (including cranes); and isolated disused and derelict buildings. A number of these are listed, most notably the Grade I listed former Curzon Street Station building which is dominant in form, and now sits in contrast within the surrounding landscape. This prominent heritage asset is a remnant of the area's industrial past. The listed public houses are individually rich in character but are limited in scale, extent and unity, and therefore have limited influence on the surrounding landscape.
- 9.3.7 There are two distinct areas of open space: the recently developed Eastside City Park, in the north, along the frontage of Millennium Point stretching towards the city centre; and Park Street Gardens, further to the west. Eastside City Park contains formal lawns, a canal water feature, specimen tree planting, formal planting beds, and paved areas. The former use of Park Street Gardens as a burial ground is evidenced by the remnants of headstones within the open grass and mature trees. The condition of these open spaces is good.
- 9.3.8 However, the extensive areas of previously developed, vacant land and the derelict state of the remaining built form which are in poor condition degrade the landscape. Despite the provision of open space, the presence of traffic and construction noise, along with the high levels of pedestrian activity and location close to the city centre results in low tranquillity. Although, there are extensive areas of derelict land, car parking and redevelopment, the abundance of heritage assets results in a borough value. Therefore, this area has a medium sensitivity to change.

Visual baseline

- 9.3.9 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-026 Part 2. A summary description of the distribution and types of receptors most likely to be significantly affected is provided below. The viewpoints are shown in Volume 2: Maps LV-07-100b to LV-07-102 and LV-08-100b to LV-08-102. The viewpoints are numbered to identify their locations, which are shown in Volume 2: Maps LV-07-100b to LV-07-102. In each case, the middle number (xxx.x.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and healthcare institutions, and 6: Employment.
- 9.3.10 No protected views have been identified within the study area.
- 9.3.11 Residential receptors have a high sensitivity to change and are located towards the edges of Birmingham city centre, along Drews Lane and around the site of the former Alstom works site, in addition to other urban residential areas in Saltley, Vauxhall and the city centre. Views are set within an urban context with existing built form, areas of derelict land, and existing road and railway infrastructure frequent elements within views.

- 9.3.12 Recreational receptors, also with a high sensitivity to change, are located within urban parks and recreation grounds and along the canal towpaths associated with the Grand Union Canal and the Digbeth Branch Canal. The viewpoints within urban parks and recreation areas typically have mature trees within the view; however due to topography and the height of surrounding buildings visual connection with the surrounding area is possible. Along the canals, incidental vegetation and boundary walls, as well as built form, provide some degree of enclosure.
- 9.3.13 Transport receptors have a low sensitivity to change. These receptors include people travelling on urban roads and pedestrian routes such as Moor Street Queensway, Park Street, the elevated pedestrian route adjacent to St Martins Queensway, and other urban roads within Birmingham. The views are characterised by urban development including high rise and industrial buildings. In most instances, the views are characterised by heavy traffic.
- 9.3.14 Hotel receptors have a medium sensitivity to change. The Hotel La Tour is located in the Eastside area on the edge of the centre of Birmingham. The hotel's guests have views across Eastside and towards the Warwick Bar Conservation Area and beyond.

Future baseline

- 9.3.15 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 will introduce new visual receptors which may be significantly affected are also described. These developments are shown in Volume 5: Map CT-13-068b to CT-13-070-R1.

Construction (2017)

- 9.3.16 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. The following has been considered in relation to landscape character and nature of views.
- views towards the Proposed Scheme from employment receptors on Jennens Road and within the McLaren Building (viewpoints 389.6.015 and 391.6.004 – refer to Volume 5: Appendix LV-001-026 for the baseline description) will be largely screened by the assumed completion of the Birmingham City University, City Centre Campus (2012/04578/PA), and Masshouse Plot 7 (2007/01816/PA) developments;
 - the Eastside Locks development (2008/02942/PA) will introduce new residential, hotel and employment receptors within the study area (viewpoint 389.2.013 – refer to Volume 5: Appendix LV-001-026 Part 2 for the baseline description). This viewpoint will also be representative of views from new educational receptors within the Birmingham City University City Centre Campus: Phase II development; and
 - the Typhoo Wharf (2007/01816/PA), former Central Fire Station development (2012/06883/PA), Masshouse Plot 7 (2007/01816/PA) and Beorma Quarter development (2009/00295/PA and 2012/02104/PA) will introduce new residential receptors within the study area (viewpoints 390.2.001, 391.2.007,

391.2.001 and 390.2.010, respectively – refer to Volume 5: Appendix LV-001-026 for the baseline description).

Operation (year 1 – 2026)

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

9.4 Temporary effects arising during construction

- 9.4.1 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. 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, main earthworks, structure works and construction of Curzon Street station and Washwood Heath depot.
- 9.4.2 The effects associated with the peak construction phase in the Washwood Heath to Curzon Street area will generally be considered to be long term given the construction programme (see Section 2.3). Overall, civil engineering works in this area will be undertaken between the start of 2017 and the end of 2022. The Bromford tunnel west portal (east) main compound will be in place for approximately five years and nine months. The Curzon Street station main compound will be in place for seven years. Satellite compounds will be in place for between approximately two years and three months and seven and a half years. The civil engineering works at most individual sites along the route in the Washwood Heath to Curzon Street area will occur for a period of between approximately two years and five years and nine months. 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.
- 9.4.3 The construction works that have been taken into account in determining the effects on landscape and visual receptors include:
- construction of the route of the Proposed Scheme, including overhead line equipment;
 - excavation and construction of Bromford tunnel and Bromford tunnel west portal;
 - demolition of buildings and structures at the proposed Washwood Heath depot site, including demolition of 12 properties on Common Lane;
 - construction of buildings and infrastructure (including balancing ponds) associated with the proposed Washwood Heath depot and Bromford auto-transformer station;
 - diversion of Washwood Heath Brook and River Rea Overflow Channel;

- demolition of the existing and construction of the new Washwood Heath rail overbridge, Aston Church Road overbridge and B4114 Saltley Viaduct;
- construction of the Saltley canal underbridge;
- alteration to Duddeston Mill Road and Duddeston Mill Road bridge;
- construction of Duddeston Junction, Curzon Street No.1, Curzon Street No.2 and Curzon Street No.3 viaducts;
- demolition of buildings including business and industrial units in Saltley, the Curzon Gateway student accommodation and the Grade II listed Fox and Grapes public house;
- construction of balancing ponds along the route of the Proposed Scheme;
- alterations to the locally listed Eagle and Tun public house to remove its roof and incorporate it into the proposed Curzon Street station;
- highway works to divert New Canal Street behind the Grade II listed Woodman public house, partially within Eastside City Park;
- the temporary re-routing of the Digbeth Branch and Grand Union canal towpaths;
- construction of Curzon Street station, including the closure of roads in the vicinity;
- construction of Curzon Street auto-transformer station near Curzon Circle;
- removal of all of Park Street Gardens, including the existing mature tree cover;
- temporary main and satellite construction compounds, site access points, site access routes and haul routes, localised construction traffic and temporary fencing and hoardings associated with the Proposed Scheme; and
- lighting at construction sites during construction activities.

Avoidance and mitigation measures

9.4.4

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

- maximising the retention and protection of existing trees and vegetation where possible (draft CoCP, Section 12);
- use of well-maintained hoardings and fencing (draft CoCP, Section 5);
- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses (draft CoCP, Section 5);
- replacement of any trees intended to be retained which may be accidentally felled or die as a consequence of construction works (draft CoCP, Section 12); and

- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed (draft CoCP, Section 12).

9.4.5 These measures have been taken account of in the assessment of the construction effects below.

Assessment of temporary impacts and effects

9.4.6 The most apparent changes to landscape character and viewpoints during construction will relate to the temporary presence of construction plant (including cranes) and construction compounds (main and satellite), the removal of existing landscape elements, such as trees and hedges, and demolition of buildings and structures. Changes will be most notable in and around the proposed Washwood Heath depot site and the proposed Curzon Street station. The height of the construction plant and viaducts and the close proximity of construction activities to viewpoints, coupled with the absence of intervening screening (apart from the site hoardings) will result in significant visual effects during construction.

Landscape assessment

9.4.7 The following section describes the likely significant effects on LCAs during construction. All LCAs within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-026 Part 4.

Washwood Heath Rail Corridor Landscape Character Area

9.4.8 The route of the Proposed Scheme will run in a tunnel, in an east-west direction from the adjoining Castle Bromwich and Bromford area (CFA25). The proposed Bromford tunnel west portal will be located approximately 150m west of the A4040 Bromford Lane roundabout, and the route of the Proposed Scheme will follow the Birmingham and Derby line (with the west section retaining walls running for 1.25km from the tunnel portal). The route of the Proposed Scheme will be on viaduct soon after the existing B4114 Saltley Viaduct until it reaches its end point at the proposed Curzon Street station, 250m beyond the Washwood Heath Rail Corridor LCA boundary. From the Vauxhall area, the route of the Proposed Scheme will follow an alignment just north of the LCA boundary, always remaining within 500m of the LCA, until it reaches the Curzon Street No.3 viaduct.

9.4.9 The main construction activities associated with the Proposed Scheme, directly impacting the LCA, will include:

- diversion of the Washwood Heath Brook, large scale earthworks, and demolition and construction of buildings and infrastructure within the proposed Washwood Heath depot;
- excavation and construction relating to the Bromford tunnel and Bromford tunnel west portal (including movement of the tunnel boring machine within its associated work area, construction of narrow gauge railway, conveyors, segment yard, temporary offices and welfare);

- demolition of existing bridges and viaducts including the Washwood Heath rail overbridge, Aston Church Road overbridge and B4114 Saltley Viaduct;
- construction of bridges and viaducts including replacement Washwood Heath rail overbridge, Aston Church Road overbridge, Saltley canal underbridge and B4114 Saltley viaduct;
- alteration of existing structures such as Duddeston Mill Road bridge and lowering of the carriageway of Duddeston Mill Road;
- construction of the route, within retaining wall section (1.25km length from Bromford tunnel west portal), at grade and on viaduct from Duddeston Junction viaduct;
- introduction of lighting; and
- introduction of other associated infrastructure including auto-transformer station, communication masts and signage (some temporary relating to diversion or realignment of roads and utility diversions).

- 9.4.10 The presence and movement of tall construction plant in relation to the above activities and the addition of temporary features, including a main and satellite construction compounds, haul routes; erection of temporary fencing and hoarding around construction sites; along with construction traffic, including heavy goods vehicle (HGV) movement of excavated materials and movements on public roads, will also impact on the character of the LCA.
- 9.4.11 There will be impacts on numerous components of the LCA and a discernible reduction in tranquillity, due to the construction activity. The main changes to character will relate to the presence of cranes and demolition of prominent buildings and structures. Although vegetation is minimal within this LCA, some of the most prominent vegetation along river and transport corridors will be removed to accommodate the Proposed Scheme. Therefore, the magnitude of change is considered to be medium.
- 9.4.12 The medium magnitude of change, assessed alongside the low sensitivity of the character area, will result in a moderate adverse effect.

Digbeth, Deritend and Bordesley High Streets and Warwick Bar Conservation Areas Landscape Character Area

- 9.4.13 The Proposed Scheme will cross the northern spur section of this LCA where the Curzon Street No.3 viaduct will cross the Digbeth Branch Canal and finish with the proposed Curzon Street station located immediately adjacent to the northern LCA boundary, beyond the existing Rugby to Birmingham line Viaduct. The land required to construct the Proposed Scheme extends into this LCA below this existing viaduct. The proposed Curzon Street station and Curzon Street No.3 viaduct will run along the northern boundary of the LCA, beyond the existing Rugby to Birmingham Line Viaduct, within the adjacent Eastside LCA.

- 9.4.14 The main construction activities associated with the Proposed Scheme, directly impacting the LCA, will include:
- construction of Curzon Street No.3 viaduct across the Digbeth Branch Canal, immediately to the north of the listed canal tunnel effectively enclosing a further 40m stretch of the canal;
 - the presence of construction traffic, including HGV on public roads, and at site access points adjacent to the LCA;
 - the addition of temporary construction fencing within northern areas of the LCA; and
 - highway works in proximity to the proposed Curzon Street station.
- 9.4.15 These direct impacts will bring about a substantial alteration to key characteristics of the LCA in localised areas. The indirect impacts on character will relate to the presence of cranes and the construction of Curzon Street station beyond the existing Rugby to Birmingham line Viaduct on the LCA boundary, affecting the sense of enclosure and the setting of the LCA. These activities within and adjacent to the LCA will also discernibly alter the tranquillity of the LCA. Impacts will be localised and as such, the overall magnitude of change is considered to be medium.
- 9.4.16 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Eastside Landscape Character Area

- 9.4.17 The route of the Proposed Scheme will run along the entire southern section of this LCA, with the Curzon Street No.3 viaduct terminating at the proposed Curzon Street station. This station will run parallel with, and immediately to the north of the existing Rugby to Birmingham Line Viaduct.
- 9.4.18 The main construction activities associated with the Proposed Scheme affecting this LCA will be:
- construction of Curzon Street No.3 viaduct (including overhead line equipment), and short stay car park beneath this structure;
 - construction of Curzon Street station and associated public realm;
 - construction activities and highway works including road closures, proposed service roads and taxi ranks in proximity to the Grade I listed former Curzon Street Station building;
 - construction activities in proximity to Moor Street station, including the proposed Curzon Street station's linkage to the existing Moor Street station;
 - construction traffic, including HGV movement on public roads, and at site access points within the LCA;
 - the addition of a temporary multi-storey main office and introduction of temporary fencing and site access points to the southern and northern boundaries of the LCA;

- service and utility diversions including gas, telecommunications, water (mains);
- temporary lighting to allow construction work; and
- presence and movement of cranes relating to demolition and construction activities.

- 9.4.19 The impacts on this LCA will substantially alter the key characteristics of the character area. The main changes to character will relate to the construction of Curzon Street station, in close proximity to the Grade I listed former Curzon Street Station building and the Grade II listed Moor Street station; the construction of the proposed Curzon Street No.3 viaduct (including overhead line equipment); the impact on the recently developed Eastside City Park including the removal of some hard and soft landscape elements; demolition of the Grade II listed Fox and Grapes public house; the impact of road closures on the historic street pattern; and removal of Park Street Gardens, with its mature tree cover.
- 9.4.20 The existing baseline is affected by localised construction and presence of cranes, however, the temporary large-scale construction activities associated with the Proposed Scheme within the LCA will introduce elements that noticeably alter the tranquillity of the LCA. Therefore, the magnitude of change is considered to be high.
- 9.4.21 The high magnitude of change, assessed alongside the medium sensitivity of the LCA, will result in a major adverse effect.

Visual assessment

- 9.4.22 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 may 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-001-026 Part 4.
- 9.4.23 The number identifies the viewpoint locations which are shown in Volume 2: Maps LV-07-100b to LV-07-102. In each case, the middle number (xxx.x.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and healthcare institutions, and 6: Employment.
- 9.4.24 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.

Viewpoint 380.2.011: View north-west from the rear of residences on Drews Lane

- 9.4.25 Construction activities including the demolition of the UK Mail building, and the construction of the proposed Washwood Heath depot, the Bromford tunnel west

portal and the Washwood Heath retained cut on the approach to the tunnel portal will be visible in the foreground and middle ground. The existing industrial buildings on Wolseley Drive will partially screen views from the properties located on the eastern end of Drews Lane. Boundaries to the rear of the properties will screen views from ground level, and in some instances, existing vegetation along the boundaries will filter views. Where views will be possible, they will be noticeably altered by the demolition of the UK Mail building, and the introduction of the Bromford tunnel west portal (east) main construction compound and construction plant including the tunnel boring machine. In addition, the earthmoving activities associated with the excavation of the three balancing ponds and the Washwood Heath Brook diversion to the south of the depot will be visible. The magnitude of change is, therefore, considered to be medium.

9.4.26 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

9.4.27 At night, continuous lighting is proposed at the Bromford tunnel west portal (east) main construction compound. However, given the presence of existing lighting along Wolseley Street and at the UK Mail site, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoints 380.2.002: View north-west from residences on Drews Lane; 380.2.005: View north-west from residences on Winnington Road; and 380.2.006: View north-west from residences on Drews Lane

9.4.28 Construction activities associated with the proposed Washwood Heath depot will be visible in the fore and middle ground. Existing views will be noticeably altered by the material processing centre, temporary earthworks and logistics centre stockpiles which will extend across the view forming a prominent element in the foreground of the view. The demolition of the UK Mail building and removal of existing vegetation, the introduction of site hoardings, the Bromford tunnel west portal (central) satellite compound and construction plant will be noticeable within the view. In addition, earth moving activities associated with the excavation of the three balancing ponds and the Washwood Heath Brook diversion to the south of the depot will be visible. Views from the east of Drews Lane will be limited to views of taller construction plant by intervening buildings while the demolition of the northern group of residential properties and the industrial building on Common Lane will be visible from the western end of Drews Lane. The existing brick wall along Drews Lane will screen some low level views from Winnington Road. The magnitude of change is therefore considered to be medium.

9.4.29 The view of the Proposed Scheme from viewpoint 380.2.006 during construction is illustrated on the photomontage shown in Volume 2: Figure LV-01-215.

9.4.30 The medium magnitude of change at these viewpoints assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

9.4.31 At night, continuous lighting is proposed at Bromford tunnel west portal (main) compound, the temporary stockpiles and across the wider Washwood Heath depot

construction site. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 382.2.001: View north-east from rear of residences on Common Lane

- 9.4.32 There will be oblique views of construction activities associated with the eastern end of the proposed Washwood Heath depot from the rear upper storeys of properties along the eastern side of Common Lane in the foreground and middle ground. Walls, fences and vegetation to the rear of the properties will screen views from ground level and in some instances tall evergreen vegetation will screen views from upper storeys. Where views will be possible, the foreground of the view will be dominated by the material processing centre, temporary earthworks and temporary material stockpiles, as well as the Bromford tunnel west portal (central) satellite construction compound. The middle ground of the existing view will be noticeably altered by the demolition of the UK Mail building, the introduction of construction plant including the tunnel boring machine, the excavation of three balancing ponds and the Washwood Heath Brook diversion to the south of the Washwood Heath depot. The magnitude of change is therefore considered to be medium.
- 9.4.33 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.
- 9.4.34 At night, continuous lighting is proposed at the Bromford tunnel west portal (east) main construction compound. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 382.2.002: View north from the rear of residences on Warren Road

- 9.4.35 Construction activities associated with the Proposed Scheme including the construction of the Washwood Heath depot will be visible in the foreground and middle ground from the rear of properties along Warren Road. Boundaries to the rear of the properties will provide some screening of views from ground level. Views will become more open from upper storeys. Even in winter the vegetation along the property boundaries will provide some low level filtering of views from many properties. However, views of the activities associated with the demolition of the buildings both immediately to the north of the property boundaries and beyond, and the construction of the Proposed Scheme including the maintenance shed, sidings and associated overhead line equipment will be possible. These activities will be set against the backdrop of the M6 and Birmingham and Derby line. The magnitude of change is therefore considered to be medium.
- 9.4.36 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 385.3.001: View south from the top of the mound in Mount Street Park

- 9.4.37 The construction of the Proposed Scheme will be visible in the middle ground, including the Washwood Heath depot, and the demolition and construction of the

Washwood Heath rail overbridge and the Aston Church Road overbridge. The intervening buildings to the north of the Birmingham and Derby line will provide some screening of low level views. Several buildings along the south of the Birmingham and Derby line will be demolished. Tall construction plant will be visible above the built form; however, this will be in the context of existing tall features, such as the Nechells gas holders, transmission towers and lighting columns. The magnitude of change is, therefore, considered to be medium.

- 9.4.38 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 384.2.005: View west from residences on Alum Rock Road

- 9.4.39 There will be oblique views from the upper storey residential premises on Alum Rock Road of construction activities in the middle ground including the demolition of the existing B4114 Saltley Viaduct and the construction of the new B4114 Saltley viaduct beyond the Saltley Gate roundabout. In addition, tall construction plant at the proposed Duddeston Junction viaduct, Curzon Street No.1, Curzon Street No.2 and Curzon Street No.3 viaducts will be visible, extending towards the centre of Birmingham and the proposed Curzon Street station. The Bookers warehouse building and other buildings in the left of the view will obscure views of lower level construction activities. The magnitude of change is therefore considered to be medium.

- 9.4.40 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

- 9.4.41 At night, continuous lighting is proposed at the B4114 Saltley viaduct (west) and B4114 Saltley viaduct (east) satellite construction compounds. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 387.6.002: View east from Mainstream Way

- 9.4.42 Construction activities, including at the proposed B4114 Saltley Viaduct will be visible in the foreground, which will be dominated by a construction working area surrounded by temporary fencing, extending onto the opposite bank of the River Rea. A site access point will be located in the immediate foreground. The vegetation within the working area will be cleared. The existing B4114 Saltley Viaduct, visible in the left of the view, and the large industrial building in the middle ground will be demolished. The magnitude of change is therefore considered to be high.

- 9.4.43 The high magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 387.2.011: View south-east from rear of residences on Great Francis Street and Hindlow Close

- 9.4.44 Intervening topography will partially screen views of construction activities in the middle ground in the valley below the viewpoint. However, tall construction plant at the proposed Curzon Street No.1 viaduct will be visible beyond the existing gantries along the Birmingham and Bushbury line. The construction activity will be viewed

against and extending above the existing container depot and the urban background of the Bordesley Green area of Birmingham. The magnitude of change is therefore considered to be medium.

- 9.4.45 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 389.2.004: View south-west from residences on Northumberland Street

- 9.4.46 The fencing surrounding the construction working area on the northern side of the proposed Curzon Street No.2 viaduct and the activities associated with the construction of this structure together with the proposed vehicle turning head at the southern end of Northumberland Street will be visible in the foreground. Two site entrances will be located off Northumberland Street resulting in views of construction traffic. The construction activities will form a dominant temporary element within the view. The magnitude of change is therefore considered to be high.
- 9.4.47 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.
- 9.4.48 At night, temporary lighting at the proposed Curzon Street No.2 viaduct will be visible in the foreground of the view. The lighting will be viewed within the context of existing lighting within Vauxhall and the wider Birmingham area. However, the construction lighting will be much brighter than the existing street lighting and will be in areas of the view which are currently not directly lit. The magnitude of change to this receptor at night is therefore considered to be medium resulting in a moderate adverse effect.

Viewpoint 389.2.001: View south from residences on Felsted Way

- 9.4.49 Tall construction plant at the elevated section of the route of the Proposed Scheme, including the proposed Curzon Street No.2 and Curzon Street No.3 viaducts will be visible in the middle ground. While lower level construction activities will be mostly screened by intervening built form, occasional glimpsed views will be possible along the streets located in close proximity to the site. In addition, it will be possible to view the activities associated with the demolition of the Curzon Gateway student accommodation. However, even in winter the vegetation in the foreground of the view will provide some filtering of views.
- 9.4.50 From Dovey, Trent and Humber Towers, views of tall construction plant at the elevated section of the route of the Proposed Scheme will become more open, particularly from the upper storeys of these tower blocks. The intervening vegetation within Barrack Street recreation ground, in conjunction with built form in proximity to the Proposed Scheme, will provide some screening of lower level views.
- 9.4.51 On balance, the magnitude of change is considered to be medium. The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

- 9.4.52 At night, continuous lighting is proposed at the Curzon Street No.3 viaduct satellite construction compound. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 388.3.006: View north-west from Garrison Lane Park

- 9.4.53 Tall construction plant associated with the proposed Curzon Street station, the Curzon Street No.3 viaduct and the proposed new traffic signal controlled junction at Garrison Circus on the A4540 Lawley Middleway will be visible in the foreground and middle ground of the view. The construction activity will be viewed against the urban background of Birmingham city centre. To the east, activity relating to the demolition of the Curzon Gateway student accommodation will be visible. Intervening built form will provide screening of views of the lower level construction activity, and even in winter, the trees around the outside of the park will provide some filtering of views. The magnitude of change is therefore considered to be medium.
- 9.4.54 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 389.2.006: View south from residences on Barrack Street and Vauxhall Road

- 9.4.55 Construction activities associated with the elevated section of the route of the Proposed Scheme, including the proposed Curzon Street No.2 and Curzon Street No.3 viaducts will be visible in the middle ground. Intervening built form will provide some screening of low levels views, but views of the construction compound and ground level activities will be possible along St James' Place. Restricted views of the activities associated with the demolition of the buildings off St James' Place and the Curzon Gateway student accommodation, the removal of the Curzon Circle roundabout on the A4540 Lawley Middleway, including the associated vegetation, and the construction of a new four way junction will be possible. The magnitude of change is therefore considered to be medium.
- 9.4.56 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.
- 9.4.57 At night, continuous lighting is proposed at the Curzon Street No.3 viaduct satellite construction compound. However, given the restricted nature of the view and presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 389.2.008: View south-west from residences on the A4540 Lawley Middleway

- 9.4.58 There will be direct and oblique views of construction activities associated with the Proposed Scheme in the foreground and middle ground. These activities will include the demolition of the Curzon Gateway student accommodation, the removal of the Curzon Circle roundabout on the A4540 Lawley Middleway including the associated vegetation, the construction of a new traffic signal controlled junction and the Curzon Street auto-transformer station. It will be possible to view the Curzon Street No.3 viaduct satellite construction compound and construction activities associated with

the Curzon Street No.3 viaduct and the proposed Curzon Street station. The magnitude of change is therefore considered to be medium.

9.4.59 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

9.4.60 At night, continuous lighting is proposed at the Curzon Street No.3 viaduct satellite construction compound. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 389.3.010: View south from the Digbeth Branch Canal towpath

9.4.61 Activities associated with the demolition of the Curzon Gateway student accommodation building, and the construction of the proposed Curzon Street No.3 viaduct and the proposed Curzon Street station will be visible in the middle ground. The red brick walls that line the canal corridor, the red brick property in the centre of the view and Moby Dick's public house in the right of the view will provide some screening of low level construction activities. However, the construction activities will be visible across the view, extending above the existing skyline. The magnitude of change is, therefore, considered to be medium.

9.4.62 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

9.4.63 The proposed Birmingham City University City Centre Campus: Phase II development would be visible in the right of the view potentially obscuring views towards the construction activities associated with the western most section of the Curzon Street No.3 viaduct. This future baseline development may potentially reduce the significance of the effect experienced by receptors at this viewpoint. However, the worst case assessment remains as identified above.

Viewpoint 389.3.012: View south from Digbeth Canal Towpath

9.4.64 This viewpoint will not be publicly accessible for approximately 18 months to allow the construction of the Curzon Street No.3 viaduct above the towpath. However, when open, activities associated with the demolition of the Curzon Gateway student accommodation and the construction of the remainder of the Curzon Street No.3 viaduct and the proposed Curzon Street station will be visible in the fore and middle ground of the view. These activities will dominate the view. The magnitude of change is therefore considered to be high.

9.4.65 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 388.3.012: View north-west from Grand Union Canal towpath in Warwick Bar Conservation Area

9.4.66 Tall construction plant associated with the proposed Curzon Street station will be visible in the middle ground above the vehicle and pedestrian bridges that cross the Grand Union Canal and the Grade II* listed Gun Barrel Proof House. The construction activity will dominate the middle ground of the view, extending above the existing skyline and obscuring views towards the Jennens Court student accommodation and

surrounding development. The magnitude of change is therefore considered to be medium.

- 9.4.67 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 389.2.013 View south from the proposed Eastside Locks and Birmingham City University developments on Curzon Street

- 9.4.68 Construction activities associated with the Curzon Street No.3 viaduct and the proposed Curzon Street station, including the Curzon Street No.3 viaduct satellite and Curzon Street station main construction compounds will be visible in the foreground and middle ground. The temporary fencing which will surround the working area on the north side of the proposed Curzon Street station and the site access point near the Digbeth Branch Canal will be visible in the immediate foreground of the view. Construction activities relating to the demolition of the Curzon Gateway student accommodation will also be visible in the left of the view. The Grade I listed former Curzon Street Station building, the Grade II listed Woodman public house and elements of Eastside City Park will provide some limited screening of views. The magnitude of change is therefore considered to be medium.

- 9.4.69 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

- 9.4.70 At night, continuous lighting is proposed at the Curzon Street No.3 viaduct satellite construction compound. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 390.2.001: View north from residences within the proposed Typhoo Wharf development, Bordesley Street

- 9.4.71 Construction activities associated with the proposed Curzon Street station, the associated water mains and sewer, electricity, gas and telecommunications utility works and site traffic on Fazeley Street and New Canal Street will be visible in the middle ground. Lower level views of construction activities associated with the proposed Curzon Street station will be obscured by the built form within the Warwick Bar Conservation Area and the existing viaduct, which carries the Rugby to Birmingham line. Tall construction activities associated with the proposed Curzon Street station will be visible, forming prominent elements extending above the surrounding built form. Views will become more open from the upper storeys of the proposed Typhoo Wharf development. The magnitude of change is therefore considered to be medium.

- 9.4.72 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

- 9.4.73 At night, continuous lighting is proposed at the Curzon Street No.3 viaduct satellite construction compound. However, intervening built form will provide some screening of this construction compound. The effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 389.3.016: View south from Millennium Point

- 9.4.74 Construction activities associated with the proposed Curzon Street station and Curzon Street No.3 viaduct, including the Curzon Street station main and Curzon Street No.3 viaduct satellite construction compounds and working area on the north side of the proposed Curzon Street station will be visible in the fore to middle ground. Activities relating to the demolition of the Curzon Gateway student accommodation will also be visible in the left of the view. The construction activities will be prominent in the view. However, the former Grade I listed former Curzon Street Station building, the Grade II listed Woodman public house, the boundary treatment to the science garden (in the right of the view) and elements of Eastside City Park (in the left of the view) will provide some screening. The magnitude of change is therefore considered to be medium.
- 9.4.75 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 388.4.017: View north-west along Fazeley Street from bridge over the Digbeth Branch Canal

- 9.4.76 Tall construction plant associated with the construction of the proposed Curzon Street station will be visible in the middle ground above the bridge, which carries the railway to Birmingham New Street station. The associated water mains and sewer, electricity, gas and telecommunications utility works and site traffic on Fazeley Street will also be visible. The construction activity will dominate the middle ground of the view, extending above the existing skyline and obscuring views towards the centre of Birmingham. Construction traffic on Fazeley Street and New Canal Street will also be visible from this viewpoint. The magnitude of change is therefore considered to be medium.
- 9.4.77 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 388.4.016: View north-west along Banbury Street from in front of the Gun Barrel Proof House

- 9.4.78 Construction activities and the site access point at the junction of Andover Street and Banbury Street will be visible in the foreground. The activities associated with the construction of the proposed Curzon Street station, including the works to the locally listed Eagle and Tun public house will dominate views, obscuring views across Eastside City Park towards the Masshouse development. The magnitude of change is therefore considered to be high.
- 9.4.79 The high magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoints 389.2.023: View south-west from residences on Grosvenor Street; and 389.2.024: View south from residences at The Hive, Masshouse

- 9.4.80 The construction of the proposed Curzon Street station and the Curzon Street No.3 viaduct, including activities within the Curzon Street station main and Curzon Street No.3 viaduct satellite construction compounds and associated working areas will be

visible in the fore and middle ground from the Jennens Court student accommodation on Grosvenor Street and from The Hive, Masshouse. The former Grade I listed Curzon Street Station building and the Grade II listed Woodman public house will screen low level activities. The trees within Park Street Gardens will be removed which will open up views to the south from The Hive, Masshouse. The construction activities will dominate the view, extending above the skyline and obscuring views of the existing railway viaduct and the Warwick Bar Conservation Area beyond from lower storeys. However, views will become more open from the upper storeys. The magnitude of change is therefore considered to be high.

9.4.81 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.82 At night, continuous lighting is proposed at the Curzon Street No.3 viaduct satellite construction compound. However, given the presence of existing street lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 391.5.002: View south from Hotel La Tour, Park Street

9.4.83 Construction activities associated with the proposed Curzon Street station and the Curzon Street No.3 viaduct, including activities within the Curzon Street station main construction compound and associated working area will be visible in the foreground. Oblique views of the Curzon Street No.3 viaduct construction compound in the middle ground will also be possible. The construction activities will dominate the view, obscuring views towards the Warwick Bar Conservation Area. The trees within Park Street Gardens will be removed, which will further open up views during the construction phase. The magnitude of change is therefore considered to be high.

9.4.84 The high magnitude of change assessed alongside the medium sensitivity of the receptor will result in a major adverse effect.

9.4.85 At night, continuous lighting is proposed at Curzon Street No.3 viaduct satellite construction compound. However, given the oblique nature of the view and the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 391.2.001: View south-east from residences at the proposed Masshouse Plot 7 development

9.4.86 Construction activities associated with the proposed Curzon Street station and the proposed Curzon Street No.3 viaduct will be visible in the middle ground from the upper storeys of the proposed Masshouse Plot 7 development. The Hotel La Tour and the Hive buildings within the existing Masshouse development will provide some screening of views. However, the generally open nature of the land around these buildings means that glimpsed views of lower level construction activities will be possible between the buildings. In addition, tall construction activities will be visible above the Hotel La Tour. Construction activities will form a noticeable element extending across the panoramic view from the upper storeys of the proposed development. The magnitude of change is therefore considered to be medium.

- 9.4.87 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.
- 9.4.88 At night, continuous lighting is proposed at Curzon Street No.3 viaduct satellite construction compound. However, given the presence of existing street lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 390.4.022: View north-east from the corner of Shaws Passage and Park Street

- 9.4.89 Construction activities associated with the proposed Curzon Street station and the associated site traffic on Park Street and Shaws Passage will be visible in the middle ground. Lower level views of construction activities will be obscured by the Taboo Cinema Club building and the retaining wall, which lines the Rugby to Birmingham line as it approaches Birmingham New Street station. However, cranes and other high level activities associated with the construction of the proposed Curzon Street station will be visible, forming prominent elements within the middle ground of the view. The magnitude of change is therefore considered to be medium.
- 9.4.90 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 391.4.020: View south from the junction of Albert Street and Moor Street Queensway

- 9.4.91 The construction working area that will front onto Moor Street Queensway and the construction activities associated with the proposed Curzon Street station will be visible in the foreground. The construction activities will dominate the view, with tall construction plant extending above the existing skyline. The mature trees within Park Street Gardens will be removed and the Grade II listed Fox and Grapes public house demolished, temporarily opening up views across Eastside and the east of Birmingham. Intermittent screening of views of the construction activities will be afforded by buses and other traffic that pass along and stop on Moor Street Queensway. The magnitude of change is therefore considered to be medium.
- 9.4.92 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 390.4.011: View north-east from the elevated pedestrian bridge between the Selfridges building and the Bullring Moor Street car park

- 9.4.93 The semi-opaque covering to the bridge will restrict the majority of views of construction activities associated with the proposed Curzon Street station from passing pedestrians. However, the proposed Curzon Street station and the Curzon Street No.3 viaduct will be visible in the middle ground through the clear sections of the covering and from the ends of the pedestrian bridge. Moor Street station will provide some limited screening of lower level views, but tall construction plant will extend across the middle ground of the view. In addition, the mature trees within Park Street Gardens will be removed and the Grade II listed Fox and Grapes public house will be demolished temporarily opening up views towards Eastside. The magnitude of change is therefore considered to be medium.

- 9.4.94 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 391.4.009: View south-east from entrance to Marks & Spencer on Moor Street Queensway

- 9.4.95 The temporary fencing which will surround the working area that will front onto Moor Street Queensway and the construction activities associated with the proposed Curzon Street station will be visible in the foreground. The construction activities will dominate the middle ground of the view, with tall construction activities extending above the existing skyline. The mature trees within Park Street Gardens will be removed opening up views eastward across the suburbs of Birmingham. Intermittent screening of views of the construction activities will be afforded by the buses that pass along Moor Street Queensway. The magnitude of change is therefore considered to be medium.

- 9.4.96 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 390.4.009: View east from the elevated pedestrian route adjacent to St Martins Queensway

- 9.4.97 Construction activities associated with the proposed Curzon Street station will be visible in the foreground and middle ground. Temporary fencing surrounding the working area that will front onto Moor Street Queensway will also be visible. The billboard on Moor Street Queensway and the trees within Park Street Gardens will be removed, and the Grade II listed Fox and Grapes public house demolished. Moor Street station will provide some low level screening of views of the taller construction activities, which will extend above the existing skyline. The magnitude of change is therefore considered to be medium.

- 9.4.98 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 391.2.015: View east from residences within the Rotunda

- 9.4.99 Construction activities associated with the proposed Curzon Street station and the Curzon Street No.1, Curzon Street No.2 and Curzon Street No.3 viaducts will be visible in the middle ground from the upper storeys of the Rotunda. The Pavilions and the Bullring shopping centres will provide some screening of views from lower storeys of the Rotunda; however, it will be possible to view the taller construction activities above these buildings. Construction activities will form a noticeable element within the view. The magnitude of change is therefore considered to be medium.

- 9.4.100 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

- 9.4.101 At night, continuous lighting is proposed at the Curzon Street No.3 viaduct satellite construction compound. However, given the separation distance and the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Cumulative effects

- 9.4.102 Volume 5: Appendix CT-004-000 and Volume 5: Map CT-13-068b to CT-13-070-R1 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. There are no committed developments which are known to be under construction at the same time as the Proposed Scheme, and therefore, there are no consequential cumulative effects on LCAs and viewpoints.

Other mitigation measures

- 9.4.103 To further reduce the significant effects described above, consideration of where planting can be established early in the construction programme will be given during the detail design stage. This may include consideration of early planting in ecological mitigation sites which would have the additional benefit of providing some visual screening. However, not all landscape and visual effects can be practicably mitigated due to the visibility of construction activity and the sensitivity of surrounding receptors. Therefore, no other mitigation measures are considered practicable during construction

Summary of likely residual significant effects

- 9.4.104 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 recreational areas and 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:
- Washwood Heath depot (continuous operation) including Bromford tunnel west portal;
 - the route of the Proposed Scheme including presence of overhead line equipment and regular high speed trains (coming out of tunnel near the A4040 Bromford Lane roundabout, in retaining wall section for 1.25km from the tunnel portal, at grade from Washwood Heath until just beyond B4114 Saltley Viaduct and then on viaduct until it reaches its destination at the proposed Curzon Street station);
 - the proposed Curzon Street station (approximately 19-30m above existing ground levels), and associated infrastructure, surrounding public realm and lighting;
 - balancing ponds; and
 - perimeter fencing.

Avoidance and mitigation measures

9.5.2 The operational assessment of impacts and effects is based on year 1 (2026), 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 to enhance and improve the Proposed Scheme include:

- planting along the route of the Proposed Scheme, including balancing ponds, and around the Washwood Heath depot; and
- tree planting and public realm works around the proposed Curzon Street station.

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 likely significant effects on the landscape character and viewpoints in operation will arise from the removal of existing landscape elements and vegetation, including Park Street Gardens and at Eastside City Park, and the introduction of large scale built infrastructure and development including the route of the Proposed Scheme on viaduct and the proposed Curzon Street station itself, with associated car parks and public realm. Together these will create a renewed landscape character within the Eastside area of Birmingham. Additional effects will arise from the presence and continuous operation of Washwood Heath depot.

Landscape assessment

9.5.5 This section sets out the LCAs significantly affected during year 1, year 15 and year 60 of operation. Non-significant effects on LCAs are presented in Volume 5: Appendix LV-001-026 Part 4.

9.5.6 The assessment of effects in year 15 assumes proposed planting has grown by approximately 450mm a year (i.e. trees would be 7 to 7.5m high). The assessment of effects in year 60 assumes all planting has reached its fully mature height.

Eastside Landscape Character Area

9.5.7 The main operation activities that will impact this LCA are:

- the presence of the proposed Curzon Street station and associated public realm with establishment of planting, increased pedestrian activity and lighting;
- the presence of Curzon Street No.3 viaduct at approximately 7 to 18m above existing ground levels depending on location (including overhead line equipment), short stay car park beneath this structure and establishment of screen planting on land adjacent to the undercroft car park; and
- the presence and movement of trains.

- 9.5.8 Tranquillity will be further reduced by the operation of the proposed Curzon Street station, including increased pedestrian and vehicle movements, and the increased lighting from the station and the external spaces surrounding it.
- 9.5.9 The proposed Curzon Street station and associated urban realm, with semi-mature tree planting, will enhance the landscape character of the area, due to the scale and high quality architectural and landscape design. This station will bring unity and cohesion in the townscape, and the new public realm will connect and integrate with Eastside City Park. The proposed station building will complement the more recent buildings within the city centre (e.g. Selfridges, Millennium Point, and Masshouse) and contrast with Grade II listed Moor Street station, the Grade I listed former Curzon Street Station building and other heritage features. The contemporary building will enhance the townscape. It will introduce a modern and interesting form to the roofscape, appropriate to the city edge skyline. The historic street pattern will in some part be lost, although there will be connectivity from Digbeth by maintaining the streets under the proposed Curzon Street station, and incorporation of the locally listed Eagle and Tun public house into the proposed station. Open grassed areas including those within Eastside City Park and Park Street Gardens will have been lost, however, a new area of tree and shrub planting will be located between the Curzon Street No.3 viaduct and the existing railway viaduct on the LCA's southern boundary. The integration of the proposed Curzon Street station and associated urban realm, along with a key linkage to the adjacent conservation area maintained by New Canal Street, will bring a new use to a previously undeveloped and predominantly poorly used area. Therefore, the magnitude of change is considered to be high.
- 9.5.10 The high magnitude of change, assessed alongside the medium sensitivity of the LCA, will result in a moderate beneficial effect.
- 9.5.11 By year 15 and year 60 of operation, the growth and maturity of planting established as part of the Proposed Scheme will result in an enhanced public realm, although the effects will remain unchanged.

Visual assessment

- 9.5.12 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-001-026 Part 4.
- 9.5.13 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.
- 9.5.14 Where significant effects have been identified, an assessment of effects at night-time arising from additional lighting has also been undertaken.
- 9.5.15 The number identifies the viewpoint locations which are shown in Volume 2: Maps LV-08-100b to LV-08-102. In each case, the middle number (xxx.x.xxx) identifies the type

of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and healthcare institutions, and 6: Employment.

- 9.5.16 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.

Viewpoint 380.2.011: View north-west from the rear of residences on Drews Lane

- 9.5.17 The buildings at the eastern end of the proposed Washwood Heath depot including the Bromford tunnel west portal headhouse, which will all be approximately 5m high, will be visible in the middle ground beyond the retained industrial buildings on Wolseley Drive. In addition, the balancing ponds to the south of the depot and the new access road and traffic will be visible. Solid boundaries, existing vegetation, and the industrial buildings retained to the south of the depot will partially filter views. However, views will become more open from upper storeys. The magnitude of change is therefore considered to be medium.
- 9.5.18 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.19 In the summer of year 1 of operation, vegetation along the rear of the properties will provide some filtering of views. The resulting effect is considered to be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.
- 9.5.20 By year 15 and year 60 of operation, the vegetation proposed along the southern edge of the proposed Washwood Heath depot will provide screening of the Proposed Scheme. The resulting effects are considered to be non-significant and are reported in Volume 5: Appendix LV-001-026 Part 4.
- 9.5.21 At night, the lighting associated with the Washwood Heath depot will be visible. However, given the existing screening and presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoints 380.2.005: View north-west from residences on Winnington Road; and 380.2.006: View north-west from residences on Drews Lane

- 9.5.22 The sidings, trains and buildings, which will be approximately 5m high, will be visible in the middle ground, extending across the entire Washwood Heath depot site. The depot site will be raised on a plateau approximately 0.5m higher than existing ground levels. The brick wall which runs along Drews Lane will provide some low level screening from Winnington Road; however, the Washwood Heath depot will be clearly visible. In addition, the three balancing ponds to the south of the Washwood Heath depot will be visible. The visual layering of overhead infrastructure associated with the various railways and sidings will increase the visual clutter within the view. However, it will be viewed against the urbanised form of the elevated M6. There will be a localised improvement in the foreground of the view where grass will replace views of a brownfield site. The magnitude of change is therefore considered to be medium.

- 9.5.23 The view of the Proposed Scheme in the winter of year 1 of operation from viewpoint 380.2.006 is illustrated on the photomontage shown in Volume 2: Figure LV-01-176.
- 9.5.24 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.25 In the summer of year 1 of operation, the vegetation proposed along the southern boundary of the Washwood Heath depot will provide a very limited degree of screening of low level views of the Proposed Scheme. The effect is therefore considered to be unchanged.
- 9.5.26 By year 15 and year 60 of operation, the vegetation proposed along the southern edge of the Washwood Heath depot will provide screening of the Proposed Scheme. The resulting effects are considered to be non-significant and are reported in Volume 5: Appendix LV-001-026 Part 4.
- 9.5.27 The view of the Proposed Scheme in the summer of year 15 of operation from viewpoint 380.2.006 is illustrated on the photomontage shown in Volume 2: Figure LV-01-266.
- 9.5.28 At night during year 1 of operation, continuous lighting associated with the Washwood Heath depot will be visible. The Proposed Scheme will introduce lighting to an area that is currently largely unlit. It will, however, be viewed against the backdrop of the lit A47 Heartlands Parkway and elevated M6, and within the context of the existing lighting on Drews Lane and Winnington Road. The magnitude of change to this receptor at night is therefore considered to be medium, resulting in a moderate adverse effect.
- 9.5.29 At night in year 15 and year 60 of operation, the vegetation proposed along the southern edge of the Washwood Heath depot will partially filter views of the lighting associated with the Washwood Heath depot. The resulting effect is considered to be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 384.2.005: View west from residences on Alum Rock Road

- 9.5.30 There will be oblique views from the upper storey residential premises on Alum Rock Road towards the new B4114 Saltley Viaduct in the middle ground. The new viaduct will broadly follow the alignment of the existing viaduct and will replace views of the existing B4114 Saltley Viaduct. However, it will be possible to view the proposed Duddeston Junction viaduct and the Curzon Street No.1 viaduct including the associated gantries and overhead line equipment, as well as the trains travelling along the elevated route, above the Bookers warehouse building and other buildings in the left of the view. The magnitude of change is therefore considered to be medium.
- 9.5.31 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.32 In the summer of year 1 of operation, the existing vegetation in front of the Staffordshire and West Midland Probation Trust building and the proposed vegetation on the embankment of the new B4114 Saltley Viaduct and along the route of the Proposed Scheme will afford no additional screening of views. However, the existing

vegetation along Adderley Road will provide some limited screening of views of the Curzon Street No.1 viaduct. The effect is therefore considered to be unchanged.

- 9.5.33 By year 15 and year 60 of operation, although the proposed vegetation on the embankment of the new B4114 Saltley Viaduct and along the route will have matured, the new B4114 Saltley Viaduct and trains on the Duddeston Junction viaduct and the Curzon Street No.1 viaduct will remain clearly visible. Therefore, the effects will be unchanged.

Viewpoint 387.6.002: View east from Mainstream Way

- 9.5.34 The new B4114 Saltley Viaduct and the route of the Proposed Scheme including the associated overhead line equipment and trains will be visible in the foreground and middle ground. The new B4114 Saltley Viaduct will broadly follow the line of the existing viaduct; however, the alignment will be altered bringing the new viaduct closer to the viewpoint. The landscaped area in the foreground of the view will be reinstated following the use of the area as a construction compound. The magnitude of change is, therefore, considered to be medium.
- 9.5.35 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.36 In summer of year 1 of operation, the vegetation planted to replace the existing vegetation removed during construction will not provide screening of views. Therefore, the effect will be unchanged.
- 9.5.37 By year 15 and year 60 of operation, although the reinstated vegetation in the foreground will have matured, the elements of the Proposed Scheme will remain clearly visible. Therefore, the effects will be unchanged.

Viewpoint 389.2.004: View south-west from residences on Northumberland Street

- 9.5.38 The Curzon Street No.2 viaduct and the proposed vehicle turning head at the southern end of Northumberland Street will be visible in the foreground. The proposed viaduct structure will dominate the view, passing over the existing Grade II listed Lawley Street Railway Viaduct and obscuring views of the sky. The magnitude of change is, therefore, considered to be high.
- 9.5.39 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.
- 9.5.40 In summer of year 1 of operation, the absence of intervening vegetation or other screening means that there will be no change to the assessment.
- 9.5.41 By year 15 and beyond to year 60 of operation, the absence of intervening planting means the effects will be unchanged.

Viewpoint 389.2.006: View south from residences on Barrack Street and Vauxhall Road

- 9.5.42 The elevated section of the route of the Proposed Scheme, including the Curzon Street No.2 and Curzon Street No.3 viaducts and the associated overhead line equipment and trains, will be visible in the middle ground. Intervening built form on

Vauxhall Road will provide some screening of views, but views will be possible along St James' Place. The Proposed Scheme will introduce a new elevated linear structure into the view. It is considered that the new viaduct will relate to the existing infrastructure elements and built form. However, due to its scale, it will form a dominant element in the view. The magnitude of change is therefore considered to be medium.

9.5.43 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.44 In the summer of year 1 of operation, the existing trees on Vauxhall Road will provide some limited screening of views. However, the effect is considered to remain unchanged.

9.5.45 By year 15 and beyond to year 60 of operation, the limited nature of the intervening planting means the effect will be unchanged.

Viewpoint 388.4.005: View north-east along Viaduct Street

9.5.46 The Curzon Street No.2 viaduct will be visible in the foreground. The new structure will dominate views along Viaduct Street and obscure views of the skyline. The magnitude of change is therefore considered to be high.

9.5.47 The high magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.48 In the summer of year 1 of operation, due to the absence of intervening planting there will be no change to the assessment.

9.5.49 By year 15 and beyond to year 60 of operation, the absence of intervening planting means the effects will be unchanged.

Viewpoint 389.2.008: View south-west from residences on the A4540 Lawley Middleway

9.5.50 The proposed new traffic signal controlled A4540 Lawley Middleway junction will be visible in the foreground. The Curzon Street auto-transformer station and the Curzon Street No.3 viaduct will be visible in the middle ground. In addition, the proposed Curzon Street station will also be visible in the right of the view. The viaduct will extend across the entire view, introducing a dominant element of elevated infrastructure into the view. However, although the new viaduct will be higher, it is considered that it will replace views of the existing Rugby to Birmingham line. The proposed Curzon Street station will introduce a new large scale building to the edge of Birmingham city centre, which will obscure some views towards the city centre. The magnitude of change is therefore considered to be medium.

9.5.51 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.52 In the summer of year 1 of operation, the existing vegetation retained along the A4540 Lawley Middleway will provide some limited screening of views. Planting around the northern boundary of the Curzon Street auto-transformer station will

provide a limited degree of screening of low level views of the Proposed Scheme. As such, the magnitude of change is considered to be unchanged.

- 9.5.53 By year 15 and year 60 of operation, although the proposed vegetation around the Curzon Street auto-transformer station will have matured, the Curzon Street No.3 viaduct and the proposed Curzon Street station will remain clearly visible. Therefore the effects will be unchanged.

Viewpoint 389.3.010: View south from the Digbeth Branch Canal towpath

- 9.5.54 The Curzon Street No.3 viaduct will introduce new large scale structure to the edge of Birmingham city centre which will be visible in the middle ground of the view, obscuring long distance views of the Bordesley area of Birmingham. The red brick walls that line both sides of the canal corridor, the red brick property in the centre of the view and the Moby Dick's public house in the right of the view will provide some low level screening of views. The Curzon Gateway student accommodation, which will have been demolished during the construction phase, will no longer be dominant within the middle ground of the view. The magnitude of change is therefore considered to be medium. The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Volume 2: Figure LV-01-178.
- 9.5.55 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.56 The proposed Birmingham City University, City Centre Campus: Phase II development, which includes a new student hub will be visible in the right of the view potentially obscuring views towards the western most section of the Curzon Street No.3 viaduct as it approaches the proposed Curzon Street station. This future baseline development may potentially reduce the significance of the effect experienced by receptors at this viewpoint during operation. However, the worst case assessment remains as identified above.
- 9.5.57 In the summer of year 1 of operation, due to the absence of intervening vegetation, it is considered that there will be no change to the assessment.
- 9.5.58 By year 15 and beyond to year 60 of operation, the limited nature of the intervening planting means the effects will be unchanged.

Viewpoint 389.3.012: View south from the Digbeth Branch Canal towpath

- 9.5.59 The Curzon Street No.3 viaduct will extend above existing ground levels across the foreground of the view. The new viaduct will dominate the view, introducing a new element of large scale elevated railway infrastructure into the view and dwarfing the existing entrance to the Grade II listed 1838 railway bridge into Curzon Street over the Digbeth Branch Canal. The new structure will obscure the current views of the sky from this location, extending the skyline upward. The magnitude of change is therefore considered to be high.
- 9.5.60 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.

9.5.61 In the summer of year 1 of operation, although the sides of the canal are lined with vegetation, due to the large scale of the proposed viaduct, it is considered that there will be no change to the assessment.

9.5.62 By year 15 and beyond to year 60 of operation, the limited nature of the intervening vegetation means the effects will be unchanged.

Viewpoint 388.3.012: View north-west from Grand Union Canal towpath in Warwick Bar Conservation Area

9.5.63 The proposed Curzon Street station will be visible in the middle ground above the vehicle and pedestrian bridges that cross the Grand Union Canal and the Grade II* listed Gun Barrel Proof House. The proposed Curzon Street station will dominate the view, extending above the existing skyline and obscuring views towards the Jennens Court student accommodation, the Aston University Campus and the Masshouse development. The magnitude of change is therefore considered to be medium.

9.5.64 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.65 In the summer of year 1 of operation, the vegetation within the Grand Union Canal basin and the Birmingham and Warwick Junction Canal basin will provide some further low level screening of views towards the proposed Curzon Street station. However, the proposed Curzon Street station will still dominate the view. The magnitude of change is therefore considered to remain unchanged.

9.5.66 By year 15 and beyond to year 60 of operation, the limited nature of the intervening vegetation means the effects will be unchanged.

Viewpoint 389.2.013 View south from the proposed Eastside Locks and Birmingham City University developments on Curzon Street

9.5.67 The Curzon Street No.3 viaduct and the proposed Curzon Street station will be visible in the foreground and middle ground. Due to the scale and their proximity to the viewpoint, these structures will dominate the view, obscuring views towards the Warwick Bar Conservation Area. The former Grade I listed Curzon Street Station building and the Grade II listed Woodman public house will provide some screening of low level views of the proposed Curzon Street station. However, these features will be dominated by the large scale form of the proposed Curzon Street station. The magnitude of change is therefore considered to be medium.

9.5.68 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.69 In the summer of year 1 of operation, the tree planting within Eastside City Park and the new planting in front of the undercroft parking and along the northern façade of the proposed Curzon Street station will provide some limited screening of views of the proposed Curzon Street station. However, due to the scale of the proposed station, it is considered that there will be no change to the assessment.

9.5.70 By year 15 and beyond to year 60 of operation, the trees proposed in front of the undercroft parking and along the northern façade of the proposed Curzon Street

station and in Eastside City Park will have matured and filter views of the proposed station. The effects are considered to be non-significant and are reported in Volume 5: Appendix LV-001-026 Part 4.

- 9.5.71 At night, continuous lighting of the proposed Curzon Street station will be visible from this location. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 390.2.001: View north from residences within the proposed Typhoo Wharf development, Bordesley Street

- 9.5.72 The proposed Curzon Street station will be visible in the middle ground, introducing a new large scale building into the view beyond the Rugby to Birmingham line Viaduct. The proposed station is considered to relate to the modern buildings on the edge of Birmingham city centre. However, the building will extend above the existing skyline, and will obscure views of the Grade I listed former Curzon Street Station building, Millennium Point and other buildings in the background of the view. The scale of the proposed Curzon Street station will dominate the view, dwarfing the existing viaduct and buildings within the Warwick Bar Conservation Area. The magnitude of change is therefore considered to be medium.
- 9.5.73 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.
- 9.5.74 In the summer of year 1 of operation, the scale of the proposed Curzon Street station and the absence of intervening vegetation mean that the assessment will be unchanged.
- 9.5.75 By year 15 and beyond to year 60 of operation, the scale of the proposed Curzon Street station and the absence of intervening planting means effects will be unchanged.
- 9.5.76 At night, continuous lighting of the proposed Curzon Street station will be visible from this location. However, given the presence of existing lighting, the effect will be non-significant and is reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 389.3.016: View south from Millennium Point

- 9.5.77 The Curzon Street No.3 viaduct will be visible in the middle ground. The proposed Curzon Street station will also be visible. These structures will, due to their scale and proximity to the viewpoint, dominate the view. The Grade I listed former Curzon Street Station building, the Grade II listed Woodman public house, and the boundary treatment to the science garden (in the right of the view) will provide some screening of low level views of the proposed Curzon Street station. However, these features will be dwarfed by the large scale form of the proposed Curzon Street station. The realignment of New Canal Street behind the Woodman public house will result in traffic being viewed side on as well as front on from this location. However, the realignment of New Canal Street will allow the space between the former Curzon Street Station building and the Woodman public house to be pedestrianised. The magnitude of change is therefore considered to be medium.

- 9.5.78 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.79 In the summer of year 1 of operation, the existing tree planting within the science garden and wider Eastside City Park and new planting along the northern façade of the proposed Curzon Street station will provide some limited screening of views of the proposed station. However, due to the scale of the proposed station, it is considered that there will be no change to the assessment.
- 9.5.80 By year 15 and beyond to year 60 of operation, the vegetation proposed along the northern façade of the proposed Curzon Street station and in Eastside City Park will have matured and provide some screening of the proposed station. The effects are considered to be non-significant and are reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 389.4.021: View south from outside the former Curzon Street Station building on New Canal Street

- 9.5.81 The proposed Curzon Street station will be visible in the foreground, introducing a new large scale building into the view. Due to the proximity to the viewpoint, the proposed station will dominate the view. The proposed station will obscure views of the Rugby to Birmingham line, the Selfridges building and other buildings on the edge of Birmingham city centre. The realignment of New Canal Street behind the Grade II listed Woodman public house will remove traffic from the immediate foreground of the view. However, while the immediate foreground will be pedestrianised, traffic will still be visible passing along New Canal Street below the proposed Curzon Street station. The magnitude of change is therefore considered to be high.
- 9.5.82 The high magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.83 In the summer of year 1 of operation, the planting along the northern façade of the proposed Curzon Street station will provide some limited screening of views of the proposed station. However, due to the scale of the proposed station, it is considered that there will be no change to the assessment.
- 9.5.84 By year 15 and year 60 of operation, although the planting along the northern façade of the proposed Curzon Street station will have matured, the proposed station will remain clearly visible. Therefore, the effects will be unchanged.

Viewpoint 388.4.016: View north-west along Banbury Street from in front of the Gun Barrel Proof House

- 9.5.85 The lower levels of the southern elevation of the proposed Curzon Street station and the end of the proposed access to the Grade II* listed Gun Barrel Proof House will be visible in the foreground from Curzon Street. The proposed Curzon Street station will dominate the view, completely obscuring views of the existing Masshouse development and the other buildings within central Birmingham. The magnitude of change is therefore considered to be high.
- 9.5.86 The high magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.87 In the summer of year 1 of operation, the direct nature of the view and the absence of intervening vegetation mean that the assessment will be unchanged.

9.5.88 By year 15 and beyond to year 60 of operation, the direct nature of the view and the absence of intervening planting mean that effects will be unchanged.

Viewpoints 389.2.023: View south-west from residences on Grosvenor Street; and 389.2.024: View south from residences at The Hive, Masshouse

9.5.89 The proposed Curzon Street station will be visible in the middle ground. The large scale building will dominate the view markedly altering the existing skyline. It is considered that the proposed station will relate to the modern built form on the edge of Birmingham city centre. The proposed station will obscure views across the Warwick Bar Conservation Area and the south of Birmingham. The former Curzon Street Station building and vegetation in Eastside City Park will provide some screening of low level views. The magnitude of change is therefore considered to be medium.

9.5.90 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.91 In the summer of year 1 of operation, the proposed Curzon Street station will replace views of the trees within Park Street Gardens on the edge of the city centre. However, the existing trees within Eastside City Park and those proposed along the northern façade of the proposed Curzon Street station will provide some filtering of lower level views of the proposed station. However, due to the scale of the building, it is considered that there will be no change to the assessment.

9.5.92 By year 15 and beyond to year 60 of operation, the trees proposed along the northern façade of the proposed Curzon Street station and in Eastside City Park will have matured and provide some screening of the proposed station. The effects are considered to be non-significant and are reported in Volume 5: Appendix LV-001-026 Part 4.

9.5.93 At night, continuous lighting of the proposed Curzon Street station will be visible from this location. However, given the presence of existing lighting, effects will be non-significant and are therefore reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 391.5.002: View south from Hotel La Tour, Park Street

9.5.94 The proposed Curzon Street station will be visible in the middle ground. The proposed station will introduce a new large scale piece of architecture and associated landscaping to the view. However, the building will dominate the view extending above the Grade I listed former Curzon Street Station building and the existing skyline. The proposed station will obscure views of the Rugby to Birmingham line and the Warwick Bar Conservation Area beyond. The magnitude of change is therefore considered to be medium.

9.5.95 The medium magnitude of change assessed alongside the medium sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.96 In the summer of year 1 of operation, the new trees planted along the northern façade of the proposed Curzon Street station, will provide partially filtered views of the

proposed station. However, due to the scale of the proposed Curzon Street station, it is considered that there will be no change to the assessment.

- 9.5.97 By year 15 and beyond to year 60 of operation, the trees planted along the northern elevation of the proposed Curzon Street station will have matured and provide some screening of the proposed station. The effects are considered to be non-significant and are reported in Volume 5: Appendix LV-001-026 Part 4.
- 9.5.98 At night, continuous lighting of the proposed Curzon Street station will be visible from this location. However, given the presence of existing lighting, effects will be non-significant and are therefore reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 391.2.001: View south-east from residences at the proposed Masshouse Plot 7 development

- 9.5.99 The proposed Curzon Street station, the Curzon Street No.3 viaduct and trains will be visible in the middle ground from the upper storeys of the proposed development at Masshouse Plot 7. The Hotel La Tour and the Hive buildings within the existing Masshouse development will provide some screening of views. However, the generally open nature of the land around these buildings means that lower level views of the proposed Curzon Street station and the Curzon Street No.3 viaduct will be possible between the buildings. In addition, the roof of the proposed Curzon Street station will be visible above the Hotel La Tour. It is considered that the building will relate to the other elements of modern architecture in the surrounding area enhancing the view of the Eastside area of Birmingham. However, the proposed Curzon Street station and the Curzon Street No.3 viaduct will dominate the middle ground of the view, obscuring views into the Warwick Bar Conservation Area. The magnitude of change is therefore considered to be medium.
- 9.5.100 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.
- 9.5.101 In the summer of year 1 of operation, planting along the northern façade of the proposed Curzon Street station will be visible. However, it will be possible to view the proposed station above and below the canopies of the trees. On balance, due to the scale of the proposed station, it is considered that there will be no change to the effect.
- 9.5.102 By year 15 and beyond to year 60 of operation, the trees planted along the northern elevation of the proposed Curzon Street station will have matured, partially screening views of the proposed station. The effects are considered to be non-significant and are reported in Volume 5: Appendix LV-001-026 Part 4.
- 9.5.103 At night, continuous lighting of the proposed Curzon Street station will be visible from this location. However, given the presence of existing lighting, effects will be non-significant and are therefore reported in Volume 5: Appendix LV-001-026 Part 4.

Viewpoint 390.4.022: View north-east from the corner of Shaws Passage and Park Street

- 9.5.104 The proposed Curzon Street station will be visible in the middle ground. The proposed station will be visible above the walls that line the railway cutting, which connects to

Birmingham New Street. The Taboo Cinema Club building will provide some screening of views. The proposed station will be visible beyond this, introducing a new element of large scale architecture to the view, which will relate to the surrounding modern architecture on the edge of Birmingham. However, the proposed station will dominate the middle ground, obscuring views towards the Masshouse development, reducing the amount of sky visible from this location and increasing the sense of enclosure within the view. The magnitude of change is therefore considered to be medium.

- 9.5.105 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.106 In the summer of year 1 of operation, the scale of the proposed Curzon Street station and the absence of intervening vegetation mean that the assessment will be unchanged.
- 9.5.107 By year 15 and beyond to year 60 of operation, the scale of the proposed Curzon Street station and the absence of intervening planting means effects will be unchanged.

Viewpoint 391.4.020: View south from the junction of Albert Street and Moor Street Queensway

- 9.5.108 The frontage of the proposed Curzon Street station on Moor Street Queensway will be visible in the foreground. The proposed station will dominate the view, extending above the existing skyline. The proposed station will obscure views east over Birmingham. However, it is considered that the proposed station will relate to the surrounding modern buildings on the edge of Birmingham. Intermittent screening of views will be afforded by buses and other traffic that pass along and stop on Moor Street Queensway. The magnitude of change is therefore considered to be medium.
- 9.5.109 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.110 In the summer of year 1 of operation, the trees along the central reservation on Moor Street Queensway and trees planted along the northern façade of the proposed Curzon Street station will partially filter views of the proposed station. However, views of the proposed station will be possible above and below the canopies of the trees. On balance, due to the scale of the proposed station, it considered that there will be no change to the assessment.
- 9.5.111 By year 15 and year 60 of operation, although trees along the northern façade of the proposed Curzon Street station will have matured, the proposed station will remain clearly visible. Therefore, the effects will be unchanged.

Viewpoint 390.4.011: View north-east from the pedestrian bridge between the Selfridges building and the Bullring Moor Street car park

- 9.5.112 The semi-opaque covering to the bridge will restrict views of the proposed Curzon Street station. However, there will be middle ground views through the clear sections of the covering and from the ends of the pedestrian bridge. Moor Street station will provide some screening of lower level views of the proposed Curzon Street station.

The proposed station will introduce a new large scale element of built form to the view that will extend across the middle ground of the view. From this elevated viewpoint, the roof will form a dominant element in the view, obscuring views of Eastside and the Grade I listed former Curzon Street Station building. The magnitude of change is therefore considered to be medium.

9.5.113 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.114 In the summer of year 1 of operation, the scale of the proposed Curzon Street station means that the assessment will be unchanged.

9.5.115 By year 15 and beyond to year 60 of operation, the scale of the proposed Curzon Street station means effects will be unchanged.

Viewpoint 391.4.009: View south-east from entrance to Marks & Spencer on Moor Street Queensway

9.5.116 The proposed Curzon Street station will be visible in the foreground and middle ground. The proposed station will be much larger in scale than the adjacent Moor Street station, dominating the view and extending above the existing skyline. The proposed station will obscure views over south-east Birmingham. However, it will introduce a new element of large scale architecture to the view, which will relate to the surrounding modern elements of architecture on the edge of the centre of Birmingham. Intermittent screening of views will be afforded by the buses that pass along Moor Street Queensway. The magnitude of change is therefore considered to be medium.

9.5.117 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.118 In the summer of year 1 of operation, the trees proposed along the western façade of the proposed Curzon Street station will afford little screening of views of the proposed station but will break up the scale of the elevation. There will be no change to the assessment.

9.5.119 By year 15 and beyond to year 60 of operation, the limited intervening planting means effects will be unchanged.

Viewpoint 390.4.009: View east from the elevated pedestrian route adjacent to St Martins Queensway

9.5.120 The proposed Curzon Street station will be visible in the middle ground. The proposed station will extend above the Moor Street station and the existing skyline. In addition, the proposed covered pedestrian link between the proposed Curzon Street station and Moor Street station will be visible. The proposed Curzon Street station will introduce a new element of large-scale architecture to the view. The proposed station will obscure views of the skyline over east Birmingham, foreshortening the view. However, it is considered that the proposed station will relate well to the surrounding modern architecture on the edge of the centre of Birmingham, as well as providing a strong frontage and enclosing element to the street. The magnitude of change is therefore considered to be medium.

- 9.5.121 The medium magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.
- 9.5.122 In the summer of year 1 of operation, the trees proposed along the western façade of the proposed Curzon Street station will afford little screening of views of the proposed station, but will visually break up the extent of the elevation. However, the proposed station will remain clearly visible above this vegetation. As such, there will be no change to the assessment.
- 9.5.123 By year 15 and beyond to year 60 of operation, the limited intervening planting means effects will be unchanged.

Cumulative effects

- 9.5.124 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.
- 9.5.125 The proposed developments which are assumed to be completed by year 1 of operation of the Proposed Scheme will not give rise to significant effects due to the negligible change to the future landscape character and the distance from identified and prospective sensitive receptors. There is no consequential cumulative effect on LCAs and viewpoints.

Other mitigation measures

- 9.5.126 The permanent effects of the Proposed Scheme on landscape and visual receptors have been substantially reduced through incorporation of the measures described previously. Effects in year 1 of operation may be further reduced by establishing planting early in the construction programme, which will be considered during the detail design stage. This would provide additional screening and greater integration of the Proposed Scheme into the landscape. However, no other mitigation measures are considered practicable due to the high visibility of elements of the Proposed Scheme and the sensitivity of the surrounding receptors.

Summary of likely residual significant effects

- 9.5.127 As no other mitigation measures are considered practicable, the permanent residual significant effects during operation remain as described above. In most cases significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. However, the following residual effects will remain following year 15 of operation:
- effects on the character of the Eastside LCA, due to the presence of the proposed Curzon Street station and associated public realm;
 - effects on views from residences on Alum Rock Road arising from the new B4114 Saltley viaduct, Duddeston Junction viaduct and Curzon Street No.1 viaduct (viewpoint 384.2.005);

- effects on views from employment receptors on Mainstream Way arising from the new B4114 Saltley viaduct, overhead line equipment and trains along the route (viewpoint 387.2.006);
- effects on residential receptors on Northumberland Street and transport receptors on Viaduct Street arising from visibility of the Curzon Street No.2 viaduct (viewpoints 389.2.004 and 388.4.005);
- effects on residential receptors on Barrack Street and Vauxhall Road arising from visibility of Curzon Street No.2 and No.3 viaducts (viewpoint 389.2.006);
- effects on residences on A4540 Lawley Middleway arising from visibility of the Curzon Street auto-transformer station and the Curzon Street No.3 viaduct (viewpoint 389.2.008);
- effects on recreational receptors using the Digbeth Branch Canal towpath arising from visibility of Curzon Street No.3 viaduct and the eastern end of the proposed Curzon Street station (viewpoints 389.3.010 and 389.3.012);
- effects on recreational receptors on the Grand Union Canal towpath and residential receptors at the proposed Typhoo Wharf development arising from visibility of the proposed Curzon Street station (viewpoints 388.2.012 and 390.2.001); and
- effects arising from visibility of the proposed Curzon Street station on people travelling around the edge of Birmingham city centre including receptors on New Canal Street, Moor Street Queensway and the elevated pedestrian route adjacent to St Martins Queensway (viewpoints 389.4.021, 388.4.016, 390.4.022, 391.4.020, 390.4.011, 391.4.009 and 390.4.009).

10 Socio-economics

10.1 Introduction

- 10.1.1 The section reports on the assessment methodology and scope, environmental baseline, and likely significant economic and employment effects during the 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 proposed construction works will have the following relevance in terms of socio-economics in relation to:
- 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) and isolation of an area which could affect a business's operations. Any resulting effects on employment are reported at a route-wide level (see Volume 3); and
 - potential employment opportunities arising from construction in the local area (including in adjacent CFA).

Operation

- 10.1.5 The operation of the Proposed Scheme will have relevance in terms of socio-economics, in relation to the 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 Section 8 of Volume 1, the SMR (see 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 arising from engagement with stakeholders and community organisations.

10.3 Environmental baseline

Existing baseline

Study area description

- 10.3.1 Section 2 of this report provides a general overview of the Washwood Heath and Curzon Street 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 area⁵⁶.
- 10.3.2 The Washwood Heath and Curzon Street area lies within the administrative area of Birmingham City Council (BCC). The Curzon Street area is located on the margins of Birmingham's central business district and BCC's spatial strategy supports a strengthening of the city centre as a continued focus of development. The plans for the regeneration of Eastside will effectively re-integrate this cleared area of land into the city centre through large scale mixed use development including 149,000 m² of new development capable of accommodating 15,000 new jobs⁵⁷ in financial and business services along with digital and creative industries. The Big City Plan – City Centre Masterplan⁵⁸ acknowledges that the Proposed Scheme will provide significant catalyst for regeneration in the Eastside area as a contribution to its wider objectives for Birmingham in supporting 50,000 jobs.
- 10.3.3 Proposals for the Washwood Heath depot coincide with an area that had been identified as a potential strategic employment site within the emergent Birmingham Local Plan. It is currently identified as not readily available "best urban"⁵⁹ employment land in BCC's register of employment land.
- 10.3.4 Where possible, baseline data has been gathered on demographic character areas (DCA)⁶⁰ to provide a profile of local communities. Volume 5: Map SE-02-154 shows the location of the DCAs. This area contains two DCA which have been defined for Curzon Street (an area representing part of Birmingham's central business district) and Washwood Heath (a long established inner urban area).

Business and labour market

- 10.3.5 Within Birmingham, there is a wide spread of business types reflecting a diverse range of commercial activities. The top five sectors in terms of sector share of enterprise activities in Birmingham were retail (14%); professional, scientific and technical (13%); construction (8%); health (8%) and production (8%). This is shown in Figure 12⁶¹. For comparison within the West Midlands region, professional, scientific and technical and retail jointly accounts for the largest number of businesses (12% each) followed by

⁵⁶ Further information on the socio-economics baseline, with regard to business and labour market profile, within the area is contained in the Volume 5: Appendix SE-001-000.

⁵⁷ Birmingham City Council (BCC) (2011) *Eastside Masterplan, Curzon Street, Birmingham Big City Plan*, BCC, Birmingham.

⁵⁸ Birmingham City Council (BCC) (2011) *City Centre Masterplan, Birmingham Big City Plan*, BCC, Birmingham.

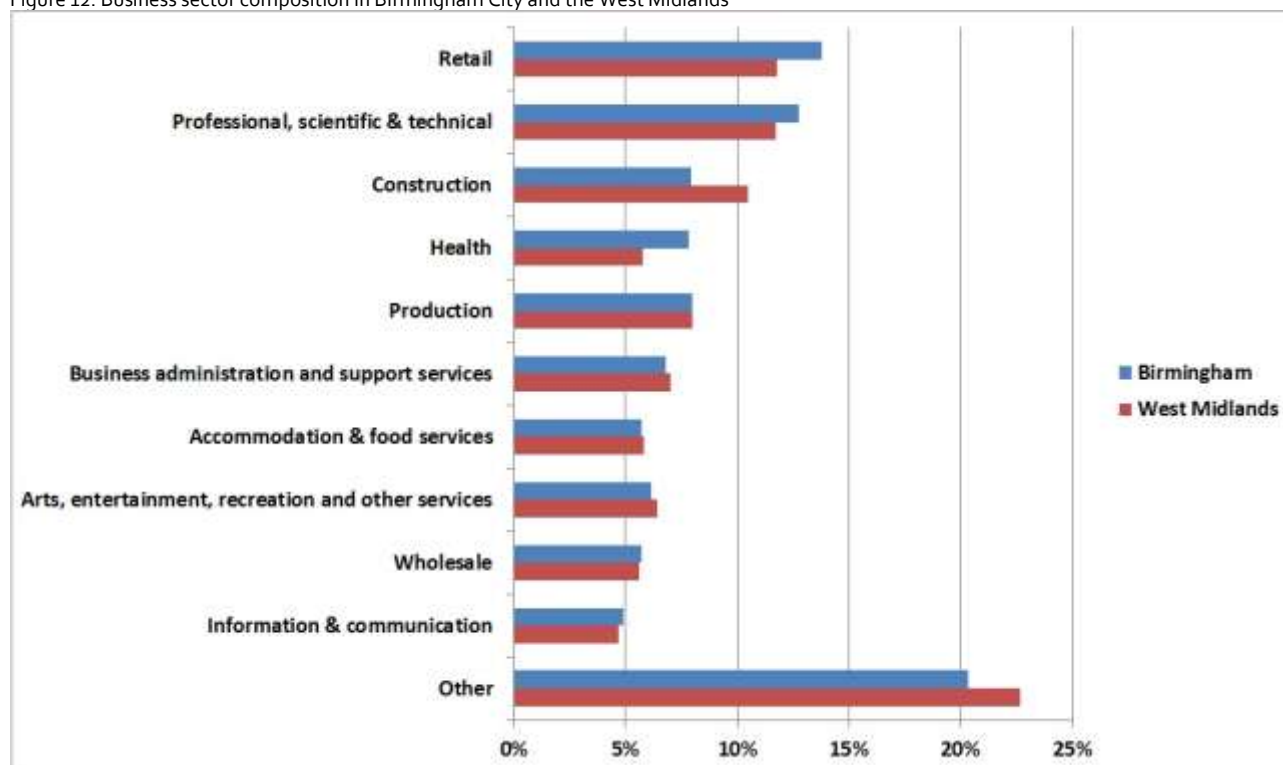
⁵⁹ Based on the Employment Land Review (2012) published by Birmingham City Council which includes a category called "Best Urban" which are high quality urban sites between 10 and 20 hectares.

⁶⁰ DCAs 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 (LSOAs).

⁶¹ Figure 12 presents the proportion of businesses within each business sector in the city but not the proportion of employment by sector.

construction (10%), production (8%) and business administration and support services (7%)⁶².

Figure 12: Business sector composition in Birmingham City and the West Midlands⁶³

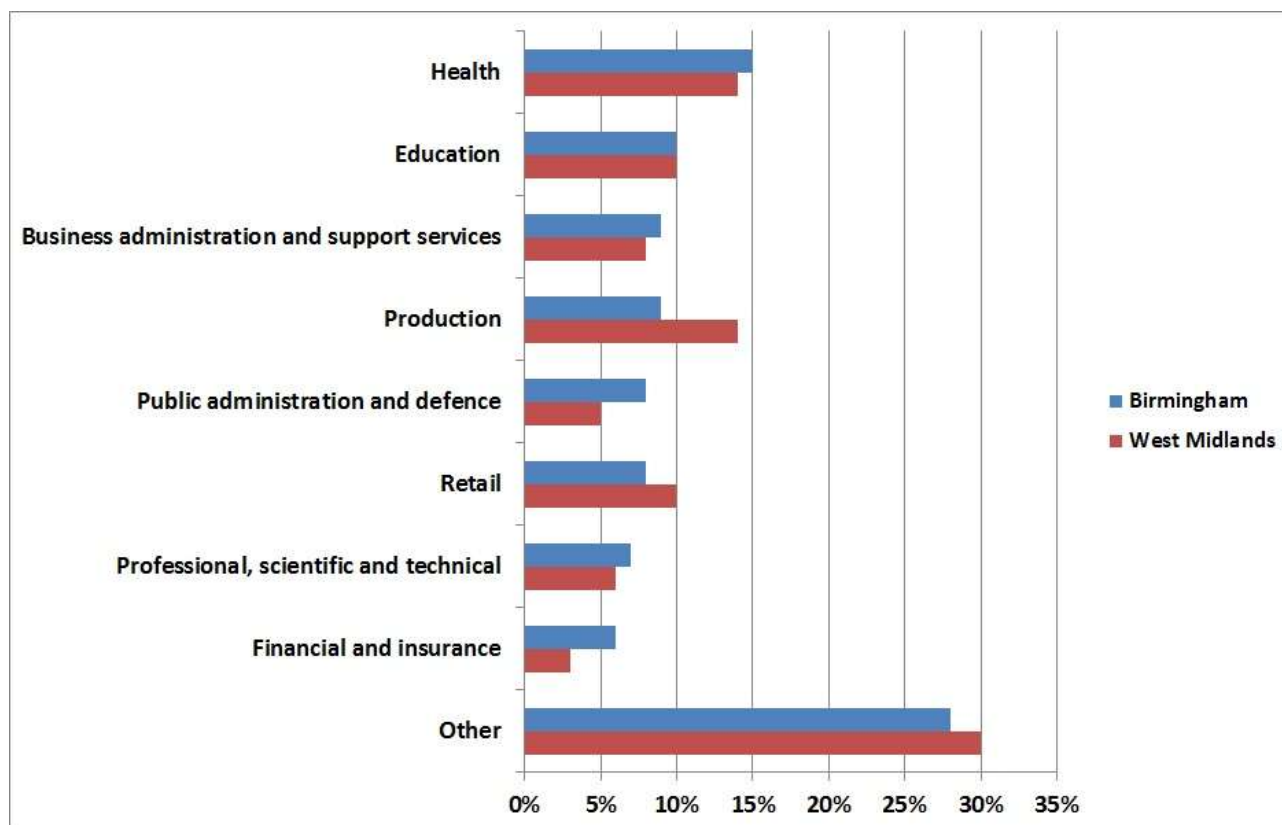


- 10.3.6 Approximately 470,000 people worked in the BCC area while 93,000 worked in Curzon Street DCA and 1,700 in Washwood Heath DCA⁶⁴.
- 10.3.7 According to the ONS Business Register and Employment Survey 2011, the top five sectors in terms of share of employment in the BCC area are health (15%); education (10%); production (9%); business administration and support services (9%) and retail (8%). These compare with the top five sectors for the West Midlands region which are health (14%); production (14%); education (10%); retail (10%); and business administration and support services (8%). This is shown in Figure 13. By comparison, within the Curzon Street DCA the top three sectors of employment were business administration and support services (18%); professional, scientific and technical (16%); and financial and insurance (14%). Within the Washwood Heath DCA, the top three sectors of employment were transport and storage (34%); professional, scientific and technical (15%); and retail (10%).

⁶² Office for National Statistics (2012), *UK Business: Activity, Size and Location 2011*. Please note 2011 data has been presented to provide an appropriate comparison with 2011 Census data.

⁶³ "Other" includes motor trades; transport and storage; finance and insurance; public administration and defence; and education sectors.

⁶⁴ Office for National Statistics (2012), *Business Register and Employment Survey 2011*.

Figure 13: Employment by industrial sector in Birmingham City and the West Midlands⁶⁵

- 10.3.8 According to the 2011 Census⁶⁶, the employment rate⁶⁷ within the BCC area was 56% (which represents 424,000 people) which is markedly lower than that recorded for both the West Midlands (62%) and England (65%). The employment rate for Curzon Street DCA was 45% and for Washwood Heath was 40%.
- 10.3.9 In 2011, unemployment rate in the BCC area was 13% which was higher than for the West Midlands (9%) and England (7%). The unemployment rate for Curzon Street was 16% and for Washwood Heath DCA was 25%.
- 10.3.10 According to the 2011 census, 23% of BCC area residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4), compared to 23% in the West Midlands and 27% in England, while 28% of residents had no qualifications which was higher than that recorded both for the West Midlands (27%) and England (23%). Qualification levels varied across the DCAs. In Curzon Street DCA 40% of residents had NVQ4 and above compared to 11% in Washwood Heath DCA. In Curzon Street DCA 5% of residents had no qualifications compared to 42% in Washwood Heath DCA.
- 10.3.11 Curzon Street DCA is partly an extension of Birmingham's central business district which is reflected in its high day time population; highly skilled resident population

⁶⁵ 'Other' includes agriculture, forestry and fishing; accommodation & food services; construction; motor trades; wholesale; transport & storage; information and communication; property and arts, entertainment, recreation & other services sectors.

⁶⁶ Office for National Statistics (2012), *Census 2011*, ONS, London.

⁶⁷ 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.

and the prevalence of higher order service sector activities typical of a major regional city.

- 10.3.12 The local economy of the Washwood Heath DCA has specialised around transport and storage activities with a lower skilled resident workforce matching the job opportunities available.

Property

- 10.3.13 In April 2012 the BCC area recorded a supply of employment land in excess of 215 hectares of which approximately 90 hectares were considered “readily available”⁶⁸. Demand for industrial space has recovered since 2010 primarily related to the activities of Jaguar Land Rover (JLR) with its sites in Castle Bromwich and Solihull which has acted as a stimulus for supplier companies to locate close to their key customer. Demand is, nevertheless, lower than that observed prior to the recession in 2008.
- 10.3.14 Average vacancy rate for industrial property in the BCC area in July 2013 has been assessed as 10% based on marketed space against known stock⁶⁹. Overall, this suggests relatively good availability of alternative accommodation and that a sufficient supply of new development land for employment use will be available based on post- recession standards of completion.

Future baseline

Construction (2017)

- 10.3.15 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. Implementation of all outstanding development consents and land allocations which can be built will result in an approximately additional 4,900 jobs⁷⁰ by 2017. However, a number of developments will be unable to proceed due to the Proposed Scheme. These are outlined below, however, there are other sites in the wider city centre area which can accommodate developments of this size and scale.
- 10.3.16 In the area surrounding Curzon Street and Albert Street the developments which will be unable to come forward include retail, financial and professional services, restaurants and cafes, offices, leisure and hotel uses, these may have accommodated 7,100 jobs. The affected development are set out in Volume 5: Appendix CT-004-000 and an overview is given below:
- Curzon Park development (2007/04646/PA) of 130,000m² including office, hotel, retail and leisure space;

⁶⁸ Based on the Employment Land Review (2012) published by Birmingham City Council which categorises employment land into Regional Investment Sites; “Best Urban” which are high quality urban sites between 10 and 20 hectares; “Good Urban” sites which are generally greater than 0.4 hectares and “Other urban” which cover average and poor sites below 0.4 hectares. The “other urban” category has not been included in the totals quoted above.

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).

⁷⁰ Potential employment has been estimated through employment floor space and the Homes and Communities Agency (HCA) Employment Densities Guide 2nd Edition (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas.

- Birmingham City University Eastside campus expansion⁷¹ (2008/03525/PA and 2009/05721/PA) including a concert hall theatre and food/drink; and
- Major mixed use development including retail, a foodstore, offices, and a hotel at City Park Gate development (2006/07395/PA and 2008/04177/PA).

- 10.3.17 Approximately a further 2,500 jobs attributable to proposed industrial, warehousing and office employment uses (2010/01996/PA and 2009/01527/PA) will be unable to proceed as a result of the Washwood Heath depot footprint.
- 10.3.18 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)

- 10.3.19 The review of future baseline conditions has not identified any additional committed developments identified within local plans, which are expected to accommodate significant additional employment between 2017 and 2026 although the plans for the regeneration of Eastside should lead to significant employment creation in the area.

10.4 Effects arising during construction

Avoidance and mitigation measures

- 10.4.1 In order to avoid or minimise the environmental impacts during construction, the Proposed Scheme design includes provisions to maintain access to businesses during the construction phase.
- 10.4.2 The draft CoCP includes a range of provisions that will help mitigate socio-economic effects associated with construction within this local area, including:
- 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 socioeconomic 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).

⁷¹ Birmingham City University appear to have reconfigured their expansion plans to the east of Millennium Point, rather than the south as evidenced by later planning permissions including 2011/00453/PA and 2012/04578/PA.

Assessment of impacts and effects

Temporary effects

Change in business amenity value

- 10.4.3 Businesses within the Washwood Heath to Curzon Street 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 Hotel La Tour is the only business considered to experience amenity impacts. The Hotel fronts a pedestrianised area, with Moor Street Queensway to the west and Park Street to the east, leading to the main hotel entrance. The hotel provides a bar, restaurant, café and conferencing facilities with capacity for up to 140 delegates. The hotel is immediately adjacent to areas required for the construction and operation of the Proposed Scheme including utility diversion works along the southern frontage of the hotel. It is expected to experience noise and vibration effects and is also close to the route identified for construction traffic along Moor Street Queensway and Albert Street. The sensitivity of this establishment is deemed to be high as users are considered to be susceptible to changes in amenity and the construction works may discourage guests. Given these in combination effects and 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 Businesses within the Washwood Heath to Curzon Street area may experience significant isolation effects as a result of construction of the Proposed Scheme. As a consequence this could lead to a loss of trade for the affected businesses.
- 10.4.7 The Proposed Scheme will cause changes to the internal circulation of traffic within the Saltley Business Park. As a result of land required for the Proposed Scheme in order to realign surrounding roads with the rebuilt B4114 Saltley Viaduct, a permanent realignment of Dorset Road and Pembroke Way/Pennine Way will be required resulting in the disruption of access to approximately seven businesses occupying ten individual property units over approximately five years. In addition, the main access into the business park off B4114 Saltley Viaduct is subject to disruption due to service diversions and bridge construction spanning approximately five years including two years of closure. The business park includes a number of businesses dependent upon the distribution of industrial products/services to other businesses. These businesses provide electrical wire; metal stockholding; catalogue goods and logistics services. Customers may be deterred from using these services if they perceive a risk to deliveries or site access leading to a potential for the diversion of trade to elsewhere. For these reasons, the disruption as a result of the Proposed Scheme is considered to represent a potential significant isolation effect on this group of businesses during construction.

- 10.4.8 The Proposed Scheme will cause changes to the internal circulation of traffic within the Network Park industrial estate, adjacent to the Duddeston Junction viaduct. The route of the Proposed Scheme will pass through the business park rising to the viaduct. New permanent access roads to the north of the estate are proposed which will be used as construction traffic routes. Utility diversion works will also take place in this area. As a result of land required for the Proposed Scheme, the western section of the internal circulation road within the industrial estate will be closed, disrupting the internal road network over approximately five years. The industrial estate includes approximately seven businesses occupying nine separate property units dependent upon the distribution of industrial products/services to other businesses including water services; medical products; automotive parts; parcel distribution and pump supplies. Businesses may be deterred from using these services if they perceive a risk to deliveries or site access leading to a potential for the diversion of trade to elsewhere. For these reasons, the disruption as a result of the Proposed Scheme is considered to represent a potential significant isolation effect on this group of businesses during construction.
- 10.4.9 The Proposed Scheme involves the creation of a series of viaducts (Curzon Street No.1, 2 and 3), linking to Curzon Street station, running in close proximity to the existing railway viaduct between Vauxhall Road and the Freightliner Terminal Depot. As a result of the Proposed Scheme, Lawford Close becomes permanently reduced in length and Viaduct Street is also permanently closed. In addition, the area is subject to restrictions/re-routing/temporary closures over approximately four years affecting four roads that provide access to Curzon Street No.2 viaduct site works including Lawford Close (remaining length after foreshortening); St James' Place; Northumberland Street; and Erskine Street. Approximately seven businesses remaining in this area will experience disruption as a result of construction works and increased traffic activity associated with the work. Business activities include a combined garage, convenience retail and fuel forecourt; combined recording studio/showroom; and distribution. For the reasons stated above, the disruption as a result of the Proposed Scheme is considered to represent a potential significant isolation effect on this group of businesses during construction.
- 10.4.10 The Proposed Scheme will affect an established business area within Birmingham long associated with traditional metal industries to the east of Digbeth and south of the inner ring road (Moor Street Queensway). This area is undergoing substantial change as a result of the contraction of traditional industries and the transition to a service led economy through market led reuse of former industrial buildings to the south east of the existing railway line viaduct serving Birmingham New Street station. New business activity has led to the gradual introduction of service activities such as cafes, cultural activities, arts and media located alongside more traditional manufacturing associated activities.
- 10.4.11 Businesses occupying buildings to the south of the existing railway line viaduct bounded by Moor Street Queensway; Digbeth (as far as the junction with Meriden Street); Meriden Street/New Canal Street and Fazeley Street will have an increase in disruption on the highways associated with both highways and utility diversion work during the construction phase of the Proposed Scheme. This includes the permanent stopping up of Banbury Street, Andover Street, Bartholomew Street, Park Street,

Freeman Street and the northern section of Fazeley Street due to the construction of Curzon Street station. These businesses include shops; snooker halls/social clubs; performance venues; distribution; banqueting halls and cafes. More of these businesses are likely to emerge by 2017 as traditional industries cede occupation to newer more service-based industries. Perceptions by customers concerning expectations of disruption may risk the diversion of trade to competitors located in areas not subject to disruption. For these reasons, the disruption as a result of the Proposed Scheme is assessed as having a potential significant isolation effect on this group of businesses during construction.

- 10.4.12 Road closures will also affect the road network to the north of the existing railway viaduct. However much of the existing business property previously serviced by these roads has already been cleared as part of the Eastside regeneration plans. By 2017, planned new development in the area will include large mixed use development led from the higher education sector in particular new student accommodation with associated leisure and retailing. These developments will extend and consolidate existing educational uses onto land to the south of Jennens Road as far as Curzon Street around Millennium Point. These developments will strengthen associations of the area to the north where an existing concentration of college and university buildings exist. The Proposed Scheme will not detract from the ability of these institutions to attract students or other facility users. Users of new development may notice an increase in heavy goods vehicle (HGV) traffic flows along Jennens Road; however, this is considered unlikely to lead to a diversion of activity from this area.
- 10.4.13 Occupiers of business units involved in distribution and trade distribution (to other businesses) off Mainstream Way, Duddeston Mill Trading Estate and Dollman Street, Inkerman Street, Alma Crescent are also likely to notice an increase in activity as a result of construction activity. Nevertheless, access will be maintained for businesses in these areas and these business resources do not share the concentration of severance, internal road disruption, and duration and construction traffic effects identified in relation to some of the above resources. Similarly, whilst bus routes into Alum Rock district shopping centre will face some disruption, alternative bus services will be available, albeit with increased journey times, but are not expected to lead to levels of delays where trade might be significantly diverted.
- 10.4.14 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3).

Construction employment

- 10.4.15 Construction compounds will consist of two main sites near the Bromford tunnel west portal (east) main compound and Curzon Street main compound (servicing civil engineering and railway installation works) plus fourteen satellite compounds. The use of these sites could result in the creation of up to 6,100 person years of construction employment⁷² or approximately 610 full-time equivalent jobs⁷³, which,

⁷² 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.

⁷³ Based on the convention that 10 employment years is equivalent to one full time equivalent job.

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 the direct construction employment creation has been assessed as part of the route wide assessment (see Volume 3).

- 10.4.16 Direct construction employment created by the Proposed Scheme could also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of this indirect construction employment creation has been assessed as part of the route wide assessment (see Volume 3).

Cumulative effects

- 10.4.17 No consented projects have been identified that are considered to interact with the Proposed Scheme.
- 10.4.18 Cumulative effects 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).
- 10.4.19 Combined effects 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

- 10.4.20 Businesses directly affected, i.e. those that lie within 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 reflecting the fact that a building may have more than one occupier or that similar businesses/resources are clustered together.
- 10.4.21 Forty business accommodation units within the area will be directly impacted upon by the Proposed Scheme. These together form four defined resources which are subject to likely significant effects on business activities and employment. These are presented in Table 11.

Table 11: Resources with likely significant direct effects

Resource	Description of business activity
Heartlands Parkway	General industrial, warehousing units and open storage
Vauxhall Road and Erskine Street and Inkerman Street	General industrial, warehousing and commercial accommodation.
Network Park industrial estate	General industrial, warehousing and commercial accommodation.
Saltley Business Park	General industrial, warehousing and commercial accommodation.

Impact magnitude

- 10.4.22 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

- 10.4.23 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

- 10.4.24 Taking account of the sensitivity of the resource and the magnitude of impact, the significance of the resultant effects is set out in Table 12.

Table 12: Significant effect on resources

Resource	Impact magnitude	Sensitivity	Significance of effect
Saltley Business Park	Medium	Medium	Moderate adverse
Network Park industrial estate	Medium	Medium	Moderate adverse
Vauxhall Road and Erskine Street/Inkerman Street	Medium	Medium	Moderate adverse
Heartlands Parkway	Medium	High	Major adverse

- 10.4.25 Part of Saltley Business Park will be required to construct the route of the Proposed Scheme at grade. Construction activities on site include demolition of buildings, realignment of the road network in order to tie into the raised B4114 Saltley Viaduct and the loss of land required to maintain business operations (land to the rear of Unit 1 Dorset Road). Aston Church Road overbridge (east) satellite compound and B4114

Saltley Viaduct (east) satellite viaduct will be located on site. Whilst data on the property market suggests that occupiers should be able to secure alternative premises the local effect on this resource and its employees is assessed to be moderate adverse and will therefore be significant.

- 10.4.26 Part of Network Park industrial estate will be required to construct the route of the Proposed Scheme as it rises onto a viaduct. New permanent access roads to the north of the estate are proposed which will also be used as construction traffic routes. Utility diversion works will also take place in this area. Construction will require the acquisition of land within the Network Park industrial estate accessed from Duddeston Mill Road involving the demolition of general industrial and distribution buildings. While the type of accommodation available on the estate is available in the rest of Birmingham the local effect on this resource and its employees is assessed to be moderate adverse and will therefore be significant.
- 10.4.27 Construction will require the acquisition of land within an area for the construction of Curzon Street No.1, 2 and 3 viaducts. This area contains a number of buildings used for employment purposes to the north of the existing Freightliner Terminal Depot bounded by Vauxhall Road and Erskine Street and Inkerman Street. This employment area is currently occupied by a range of uses including offices, distribution, retail and car repairs/services. Construction of the Proposed Scheme will also impact on businesses located in the existing viaduct arches supporting the Rugby and Birmingham line into New Street station. Construction works will prevent access to the seven units at Locke Place accessed from St James' Place rendering them inoperable for the duration of the works (four years) through loss of vehicular access. Currently these units are occupied by car repairs/testing business; small industrial workshops and vacant possession. Following completion of the works, these units are likely to become available for commercial use once again. Given the nature of the activities there is a reasonable prospect that occupiers will be able to find alternative accommodation within the Birmingham area. Certain occupiers may however have particular locational ties to the immediate area that may make relocation difficult. The local effect on this resource and its employees is assessed to be moderate adverse and will therefore be significant.
- 10.4.28 In addition, the construction of the Curzon Street No.2 viaduct will also encroach onto land attached to the West Midlands Fire Service Headquarters building currently used for the parking of vehicles. In the case of land taken from the headquarters building it is assumed this can be achieved without prejudicing future occupation of the building.
- 10.4.29 Construction will require the acquisition of industrial/warehousing land in the vicinity of A47 Heartlands Parkway between Bromford Lane and Aston Church Road including a large warehousing facility currently occupied by UK Mail. HS2 Ltd will continue to work with UK Mail to assist them with the identification of a suitable alternative site to which they can re-locate. The area is required to construct the Washwood Heath depot. Works include the complete clearance of the site, extensive drainage earthworks, a number of utility diversions, the diversion of Washwood Heath brook and the construction of structures and rail lines required to operate a large rail depot. The land required by the Proposed Scheme is broadly coincident with the sites of the former Alstom works and former Leyland DAF Vans (LDV) factory site (the latter has

been cleared of buildings). The former Alstom works site includes a mix of distribution buildings and is understood to be partially occupied on a short term let due to plans for the redevelopment of the site. Occupiers on a short term let will, therefore, have the expectation of having to find alternative premises anyway. The extant consent for approximately 100,000 m² of employment floorspace on the site may have resulted in a further 2,500 jobs however it is recognised that there are a number of alternative development sites for this type of use to take place within the wider sub region. Remaining occupiers will have particular requirements that will be the subject of specific site search and negotiation on alternatives. In addition, the employment area includes a scrap metal business; the Hanson Heidelberg and Cemex UK concrete batching plants. The effect on A47 Heartlands Parkway and its employees is assessed to be major adverse and will therefore be significant.

- 10.4.30 A number of developments have been planned on land in the vicinity of Curzon Street/Albert Street. As a result of the Proposed Scheme, these schemes will be unable to proceed. Jobs attributable to these amount to approximately 7,100⁷⁴, however it is recognised that there are a number of other development sites in the wider city centre area which could accommodate these developments. Across all the employment areas reviewed an estimated 2,600 existing jobs⁷⁵ will either be displaced or possibly lost to the wider West Midlands region although some of these jobs will be replaced as a result of operation of the Proposed Scheme. Due to the general availability of premises there is a reasonable probability that businesses will be able to relocate to places that will still be reasonably close to the area. However, there could still be a number of cases where alternative locations are difficult to find and unlikely to be replaced on a “like for like” basis within the area. The displaced or possible lost jobs, the vast majority of which relate to industrial uses, are considered to be of relative importance in terms of employment within the local economy though it is anticipated that most of these jobs will be relocated given the wider regeneration plans for the city centre area.
- 10.4.31 As highlighted previously the plans for the regeneration of Eastside takes on board the Proposed Scheme and will effectively re-integrate this area into the city centre through large scale mixed use development including 149,000 m² of new development capable of accommodating 15,000 new jobs⁷⁶ in financial and business services along with digital and creative industries.
- 10.4.32 HS2 Ltd will continue to work closely with BCC to maximise the development and regeneration opportunities provided by the Proposed Scheme.

Cumulative effects

- 10.4.33 No committed projects have been identified that are considered to interact with the Proposed Scheme.

⁷⁴ Details of these are set out in Volume 5: Appendix CT-004-000.

⁷⁵ Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency (HCA) Employment Densities Guide 2nd Edition (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary from actual employment at the sites.

⁷⁶ Birmingham City Council (BCC) (2011) *Eastside Masterplan, Curzon Street, Birmingham Big City Plan*, BCC, Birmingham.

- 10.4.34 Cumulative effects 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).
- 10.4.35 Combined effects 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).

Other mitigation measures

- 10.4.36 The assessment has concluded there are significant adverse effects arising during construction. Businesses displaced by the Proposed Scheme will be fully compensated within the provisions of the National 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.
- 10.4.37 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 working with its suppliers to build a skilled workforce that fuels further economic growth across the UK.

Summary of likely significant residual effects

- 10.4.38 Likely significant residual effects are shown on Volume 5: Maps SE-01-072b to SE-01-075.
- 10.4.39 The Proposed Scheme will require the demolition of, or otherwise render inoperable, four significantly affected socio-economic resources. Construction is also expected to lead to the isolation of businesses within the Saltley Business Park; the Network Park industrial estate and businesses located between Vauxhall Road and the Freightliner Terminal Depot. During construction, customers may be discouraged from using the Hotel La Tour off Albert Road/Curzon Street.

10.5 Effects arising during operation

Avoidance and mitigation measures

- 10.5.1 No mitigation measures are proposed 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 Proposed Scheme within this area.

Change in business amenity

- 10.5.3 No businesses have been identified within the area which are expected to experience significant amenity effects as a result of the Proposed Scheme.

Operational employment

- 10.5.4 Operational employment will be created at locations along the route including stations, train crew facilities and infrastructure/maintenance depots. Within this area there will be a station at Curzon Street containing train crew facilities and space for retail units. With the anticipated increased footfall and availability of business space this will create increased direct and wider employment.
- 10.5.5 Present plans are that 200 HS2 related jobs will be created at Curzon Street station. This excludes associated retail and other opportunities in and around the new station. The station is likely to encourage further investment in the surrounding area seeking to capture the benefits of increased activity around the station. The Washwood Heath depot is estimated to directly employ a further 500 persons. Some of these employment opportunities will be accessible to residents in the locality.
- 10.5.6 Direct operational employment created by the Proposed Scheme could also lead to indirect employment opportunities for local businesses in terms of supplying the project or benefiting from expenditure of directly employed workers on goods and services.
- 10.5.7 Some of these employment opportunities will be accessible to residents in the locality and, given the transport accessibility of the area within the Birmingham travel to work area, residents living further afield.
- 10.5.8 The impact of operational employment creation has been assessed as part of the route wide assessment (see Volume 3).

Cumulative effects

- 10.5.9 No projects have been identified that are considered to interact with the Proposed Scheme.

Other mitigation measures

- 10.5.10 The assessment has concluded that operational effects within the area will be either negligible or beneficial and therefore mitigation is not required.

Summary of likely residual significant effects

- 10.5.11 There are no significant effects arising during operation.

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 Washwood Heath to Curzon Street 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 areas⁷⁷; 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'⁷⁸.
- 11.1.2 The assessment of likely significant effects from noise and vibration on community, cultural heritage or ecological 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.
- 11.1.6 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).

⁷⁷ '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.

⁷⁸ 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).

11.1.7 More detailed information and mapping regarding the sound, noise and vibration assessment for Washwood Heath to Curzon Street 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-002-026);
- sound, noise and vibration construction assessment (Appendix SV-003-026);
- sound, noise and vibration operation assessment (Appendix SV-004-026); and
- Volume 5: Map Series SV-01, SV-02, SV-03 and SV-04.

11.2 Environmental baseline

Existing baseline

- 11.2.1 The existing baseline sound environment for this area is mixed, although as a heavily urbanised area, transportation sound sources dominate in most areas. There are a number of major railway routes, running into Birmingham New Street, Birmingham Moor Street, and Birmingham Snow Hill stations.
- 11.2.2 The M6 cuts through the north of the area, and the existing sound levels within the area are also influenced by a number of major A-roads and very busy B-roads (typical daytime sound levels close to these major roads are 65 dB⁷⁹). To the east of the area, there is some influence from aircraft movements from Birmingham Airport though this is never a dominant sound source.
- 11.2.3 The area includes a mix of residential areas, some of which are very high density, and areas of intense industrial and commercial activity bringing significant local industrial sound sources. Towards the city centre there are major educational institutions including Aston University, Birmingham City University and Matthew Boulton College and major entertainment, leisure and shopping areas, including current and proposed development in the Birmingham Eastside area. Further from major roads and industrial sound sources, typical daytime levels reduce to 55 dB, and 50 dB in the quietest locations within this area.
- 11.2.4 Few locations experience low existing baseline sound levels due to the large number of major transportation sound sources, although sound levels drop significantly during the night time⁸⁰, particularly in more residential areas (reductions of 10 dB are common away from the city centre and major roads, whilst where sound from major roads is dominant, reductions are generally closer to 5 dB).
- 11.2.5 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-026.

⁷⁹ Quoted dB values refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, L_{pAeq,16hr}.

⁸⁰ 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 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 precautionary 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. No vibration baseline measurements have therefore been undertaken.

Future baseline

- 11.2.7 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic although growth in rail is also expected. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads⁸¹, tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

- 11.2.8 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)

- 11.2.9 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 would 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 would exist in 2026 without the Proposed Scheme.

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.

⁸¹ Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

11.3.2 The following activities have been assumed to be undertaken during the evening and/or night-time for reasons of safety, engineering practicability or to reduce the impact on existing transport:

- installation and removal of temporary railway protection barriers in various locations where works are in close proximity to existing rail lines;
- erection of the tunnel boring machine (TBM) at the Bromford tunnel west portal for both tunnel drives;
- continuous surface support activities for tunnelling of the Bromford tunnel;
- tunnel finishes at the Bromford tunnel west portal;
- sheet piling at the western end of the Bromford tunnel west portal in close proximity to the Birmingham and Derby line;
- various track removal and track replacement works on the existing Birmingham and Derby line; and
- installation of the viaduct deck at the sections of Duddeston Junction viaduct and Curzon Street no. 1, no. 2 and no 3 viaducts which cross the existing Duddeston Mill Road bridge, Birmingham and Derby line, River Rea, Viaduct Street, Birmingham and Bushbury line, A4540 Lawley Middleway and the Digbeth Branch Canal.

11.3.3 In addition to the above, there will also be some night-time working during short term rail or road possession periods required to demolish a number of existing bridges, install the deck of a number of new bridges over existing railway and tie-in new road works. It is expected that the noise effects from these works would be limited in duration and would 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.

11.3.4 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.

Local limitations

11.3.5 In this area, there are a number of locations where the land or property owners 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 provided in Volume 5: Appendix SV-002-026.

Avoidance and mitigation measures

11.3.6 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 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 warnings⁸²; 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 CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.7 In addition to this mitigation, taller screening as described in the draft CoCP⁸³ has been assumed along the edge of the construction site boundary adjacent to:

- residential, commercial and community facility premises along the eastern and southern boundaries of the Bromford tunnel west portal and Washwood heath depot works;
- residential and commercial premises off Mount Street to the north and south of Aston Church Road; commercial premises in Saltley Business Park, Network Park industrial estate, Duddeston Mill Trading Estate and the Freightliner Terminal Depot;

⁸² Warning signals that consist of bursts of noise.

⁸³ 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.

- commercial premises and residential properties along the route between Erskine Street and A4540 Lawley Middleway; and
- residential, community facility and commercial properties to the north, south-east, and west of the proposed Curzon Street station and Curzon Street no.3 viaduct.

- 11.3.8 Solid cladding will be provided to the railway protection barrier proposed to the north of the Bromford tunnel west portal works and to the south of the approach to the new Curzon Street station to provide noise screening.
- 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 affected⁸⁴ 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 Act⁸⁵. 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, approximately 175 existing residential buildings, and proposed⁸⁶ residential buildings are forecast to experience noise levels higher than the noise insulation trigger levels as defined in the draft CoCP. The existing residential properties consist of approximately 70 buildings in the B4114 Washwood Heath Road area, approximately 50 buildings in the Northumberland Street area, around 50 buildings in the A4540 Lawley Middleway area and three properties in the vicinity of the proposed Curzon Street station. For daytime construction the trigger level is 75dB⁸⁷ measured outdoors, or the existing ambient if this is already above this level. For night-time construction the trigger level is 55dB⁸⁸ measured outdoors, or the existing ambient if this is already above this level.
- 11.3.12 The mitigation measures, including noise insulation, will reduce noise inside all dwellings, including those identified above, such that it does not reach a level where it would significantly affect⁸⁴ residents.

⁸⁴ Information is provided in the emerging National Planning Practice Guidance – Noise <http://planningguidance.planningportal.gov.uk>.

⁸⁵ *Control of Pollution Act (s61)* (1974) Her Majesty's Stationery Office.

⁸⁶ Eastside Locks committed development. Refer to section 2 of this report.

⁸⁷ $L_{pAeq,0800-1800}$ measured at the façade.

⁸⁸ $L_{pAeq,2200-1700}$ measured at the façade.

Residential receptors: direct effects – communities

- 11.3.13 The avoidance and mitigation measures in this area will avoid airborne construction noise and ground-borne vibration adverse effects on the majority of receptors and communities. Residual temporary noise or vibration effects that are considered significant are identified in the rest of this section.
- 11.3.14 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.
- 11.3.15 In locations with lower existing sound levels⁸⁹, construction noise effects⁸⁴ 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 context⁹⁰ as identified in Table 13.
- 11.3.16 Vibro-compaction is likely to result in appreciable ground-borne vibration at a small number of dwellings, situated closest to the activities. These receptors will also be exposed to appreciable noise from the construction of the Proposed Scheme. The significance of the identified vibration effects has been assessed in combination with the airborne noise also identified at these receptors.

⁸⁹ Further information is provided in Volume 5: Appendix SV-001-000.

⁹⁰ Further information is provided in SV-001-000 and SV-003-026.

Table 13: 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-003-026)	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact and details
CSV26-Co1	Construction noise	Day	Washwood Heath. Approximately 40 dwellings on Drews Lane.	Site mobilisation, watercourse diversion, depot buildings, reprocessing of materials, with typical and highest monthly noise levels of around 60-65dB and 70B ⁹¹ respectively.	Ranging from 6 to 24 months
CSV26-Co2	Construction noise	Day and Night	Washwood Heath. Approximately 250 dwellings on Warren Road, Common Lane, Pounds Green and Coronation Road during the day, around 40 of which also experience night-time effects.	Day: fencing, utility diversions, demolition, depot buildings, landscaping/resoiling, reprocessing of materials and logistics and storage operations, with typical and highest monthly noise levels of around 60-70dB and 70-80dB ⁹¹ respectively. Night: tunnel portal sheet piling, with typical and highest noise levels of around 45dB and 55dB ⁹² .	Day: ranging from 1 to 65 months Night: 1 month
CSV26-Co3	Construction noise	Day	Saltley. Approximately 90 dwellings on Arley Road.	Utility diversions, with typical and highest monthly noise levels of around 60dB and 75dB ⁹¹ respectively.	1 to 2 months
CSV26-Co4	Construction noise	Day and Night	Vauxhall. Approximately 50 dwellings on Northumberland Street.	Day: Demolition and viaduct works, with typical and highest monthly noise levels of around 60 and 70dB ⁹¹ . Night: Viaduct deck works with typical and highest noise levels of around 55dB and 65dB ⁹² .	Day: 9 months Night: 5 months
CSV26-Co5	Construction noise	Day and night	Vauxhall. Approximately 50 dwellings off Lawley Middleway during the night, around 20 of which also experience daytime effects.	Day: Roadworks on Lawley Middleway, with typical and highest monthly noise levels of around 65 and 75dB ⁹¹ . Night: Viaduct deck works, with typical and highest noise levels of around 50dB and 60dB ⁹² .	Day: 2 months Night: 5 months

⁹¹ Daytime: equivalent continuous sound level at the facade, L_{pAeq, 0700-1900}.⁹² Night-time: equivalent continuous sound level at the facade, L_{pAeq, 2300-0700}.

Significant effect number (see Volume 5 Appendix SV-003-026)	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact and details
CSV26-Co6	Construction noise	Day and night	Eastside. During the day approximately 2 existing dwellings off Penn Street, the Jennens Court student flats on Etna Street and the proposed Eastside Locks mixed use development off Curzon Street, of which the 2 dwellings off Penn Street and the Eastside Locks development also experience effects at night.	Day: Utility diversions, demolition, road works on Lawley Middleway and construction of the new Curzon Street station with typical and highest monthly noise levels of around 60-65 and 70dB ⁹¹ respectively. Night: Viaduct deck works, with typical and highest noise levels of around 55dB and 60dB ⁹² .	Day: Ranging from 7-20 months Night: 5 months
CSV26-Co7	Construction noise	Day	Digbeth. Approximately 15 dwellings on Bordesley Street and New Bartholomew Street.	Utility diversions, with typical and highest monthly noise levels of around 65 and 75dB ⁹¹ respectively.	1-2 months

Residential receptors: indirect effects

11.3.17 Construction traffic is likely to cause adverse noise effects on residential receptors along the following local roads:

- Cardigan Street in Digbeth between Curzon Street and B4114 Jennens Road (CSV26-Co6). Any proposed residential receptors on the boundary of the Eastside Locks committed development with Cardigan Street are forecast to experience an increase in traffic noise levels during the peak months following the permanent closure of a section of Park Street. Increases in traffic noise levels of around 7dB are predicted on the southern half of Cardigan Street and around 4dB on the northern half (further information is provided in Section 12: Traffic and Transport);
- Allison Street and Coventry Street between Allison Street and Meriden Street in Digbeth (CSV26-Co8). Residential buildings on these streets are forecast to experience a moderate increase in traffic noise levels of around 7dB, during the peak months due to localised re-routing of traffic to connect to/from New

Canal Street (further information is provided in Section 12: Traffic and Transport).

- 11.3.18 These adverse effects⁸⁴ would be a change in the acoustic character of the area⁸⁴ such that there is a perceived change in the quality of life. The effects are considered to be significant when assessed on a community basis taking account of the local context⁹⁰.
- 11.3.19 Construction traffic is also likely to cause adverse or beneficial noise effects on residential receptors along the following local very busy roads:
- Aston Church Road between Warren Road and Washwood Heath Road in Washwood Heath; Melvina Road between A47 Saltley Road and B4132 Great Francis Street in Nechells Green; and Masshouse Lane between Albert Street and Moor Street Queensway in Eastside (CSV26-C09). Residential dwellings and buildings on these streets are forecast to experience a minor increase in traffic noise levels of around 2 to 3 dB, during the peak months due to localised re-routing of traffic (further information is provided in Section 12: Traffic and Transport); and
 - B4114 Washwood Heath Road, between Aston Church Road and Alum Rock Road in Washwood Heath; B4114 Chapel Street between Jennens Road and Albert Street; and B4114 Park Street between Albert Street and Masshouse Lane, in Eastside (CSV26-C10). Residential dwellings and buildings on these streets are forecast to experience a minor decrease in traffic noise levels of between 2 and 3dB due to the localised re-routing of traffic (further information is provided in Section 12: Traffic and Transport).
- 11.3.20 The small increases and decreases in sound level on these busy roads are considered to be significant at the identified receptors as they are already exposed to high ambient noise levels⁹³.

Non-residential receptors: direct effects

- 11.3.21 Significant construction noise or vibration effects have been identified on a worst case basis on the following non-residential receptors:
- Leigh Junior, Infant and Nursery School and Hasanat College, off Warren Road, Washwood Heath (CSV26-No1). Significant noise effects have been identified during the daytime with construction levels rising at times to around 65dB and 75dB¹⁶ respectively. The rear of both the school and the college face onto the Washwood Heath depot site therefore a range of works at the depot contribute to the predicted construction noise levels. The highest noise levels are during the short term works to install solid hoarding on the southern boundary of the depot, and the demolition of existing buildings in close proximity to the boundary. The height of the hoarding between the school and college and the depot site has been maximised to provide screening to the school and college;

⁹³ E.g. 65 dB LpAeq,0700-2300 during the day.

- Masjid Ali Project Mosque on Aston Church Road, Washwood Heath (CSV26-No2). Significant noise effects have been identified during the daytime with noise levels rising at times to around 75dB⁹¹ when utility diversion works on Aston Church Road are at the closest approach. The existing ambient noise levels are also around 75dB⁹¹ at the façade facing onto Aston Church Road;
- the closest commercial units in Saltley Business Park and Network Park industrial estate to the works, including the offices of the West Midlands Probation Service (CSV26-No3). Significant noise effects have been identified during the daytime with noise levels rising at times to around 80dB⁹¹. The significant effect associated with works such as utility diversions, fencing and demolition of adjacent units when on-going in very close proximity. It has been assumed that the western façade of the buildings facing the works are in office use. The levels of construction vibration are also above the criterion for offices for short periods of time when vibro-compaction of earthworks is closest;
- Birmingham City Council (BCC) Museum Collections Centre, Dollman Street, Vauxhall (CSV26-No4). Significant noise effects have been identified during the daytime with noise levels rising at times to around 70dB⁹¹ due to a range of works mainly associated with the adjacent Curzon Street no. 1 viaduct. The main building closest to the works is of an industrial nature constructed of metal cladding with no windows facing towards the works, and this should reduce internal construction noise levels. The structural fill earthworks associated with the Curzon Street no. 1 viaduct extend to within 15m of the southern corner of the BCC Museum Collections Centre. Vibration adverse effects are forecast for short periods of time when vibro-compaction of earthworks is at its closest location to the building;
- various commercial and industrial premises to the north of the route between Erskine Street and the A4540 Lawley Middleway, Vauxhall, including the West Midlands Fire Service headquarters office building (CSV26-No5). Significant noise effects have been identified during the daytime with noise levels rising at times to around 75-80dB⁹¹. The Proposed Scheme earthworks extend to approximately 10m of the rear aspect of the West Midlands Fire Service offices. Vibration adverse effects are forecast for short periods of time when vibro-compaction of earthworks is at its closest location to the office building;
- Safeside educational facility, operated by the West Midlands Fire Service, Vauxhall (CSV26-No6). Significant noise effects have been identified during the daytime with noise levels rising to just under 80dB⁹¹ during the short term installation of fencing along the rear façade of the building. Nearby demolition works also result in a significant daytime effect with noise levels rising to just under 70dB⁹¹. The Safeside facility is an industrial style building with no apparent openings on the façade facing the construction works, and this should reduce internal construction noise levels;
- Professional Music Technology premises, A4540 Lawley Middleway (CSV26-No7). Significant noise effects have been identified during the daytime with noise levels rising to just over 75dB¹³ due to demolition of adjacent buildings

and utility diversions and road works on the adjacent A4540 Lawley Middleway. The studios are located on the ring road where existing daytime ambient noise levels are just under 70dB⁹¹;

- Millennium Point, the Parkside Building (containing the Institute of Art and Design and the School of Media) and the adjacent proposed Birmingham City University buildings and hotel at the Eastside Locks committed development (CSV26-No8). Significant noise effects have been identified during the daytime with noise levels rising to around 70dB¹³ due to a range of works associated with the new Curzon Street station and Curzon Street no. 3 viaduct, plus demolition and utility works. At night a significant noise effect on the proposed hotel has been identified with noise levels rising up to around 60dB⁹², due to works to install the deck of the Curzon Street no. 3 viaduct over the A4540 Lawley Middleway and Digbeth Branch Canal;
- Hotel La Tour, B4100 Moor Street Queensway (CSV26-No9). Significant noise effects have been identified during the daytime with noise levels rising to just over 75dB¹³ due to short term utility diversions immediately adjacent to the south-east façade of the hotel. Existing daytime ambient noise levels in this area are just under 70 dB⁹¹;
- Carrs Lane Church and St Michaels Church, on B4100 Moor Street Queensway (CSV26-No10). Significant noise effects have been identified during the daytime with noise levels rising to just under 75dB¹³ due to a range of works at the new station including demolition, utility diversions and ground engineering works. The affected facades face onto the busy B4100 Moor Street Queensway where existing daytime ambient noise levels are just under 70 dB⁹¹;
- the Taboo Cinema on Park Street (CSV-No11). Significant noise effects have been identified during the daytime with noise levels rising to over 75dB¹³ due to a range of works at the proposed Curzon Street station including demolition, utility diversions, ground engineering works and works below ground. Existing daytime ambient noise levels are just under 70 dB⁹¹ in this area and the cinema does not have any windows on the façade facing the works, therefore the effect on the premises may be limited; and
- The Polish Centre, Bordesley Street (CSV-N12). Significant noise effects have been identified during the daytime with noise levels rising to around 75dB¹³ due to a range of works at the proposed Curzon Street station including demolition, utility diversions, ground engineering works and works below ground.

Non-residential receptors: indirect effects

11.3.22 Construction traffic is likely to cause significant indirect noise effects at non-residential receptors along the following local roads:

- B4114 Saltley Viaduct and High Street between A47 Heartlands Parkway and B4114 Washwood Heath Road, in Washwood Heath, affecting various commercial and office premises which face onto the road (CSV26-N13). A temporary beneficial effect is forecast, with the major decrease in traffic noise

levels during the temporary closure of B₄₁₁₄ Saltley viaduct leading to a reduction in road traffic noise of over 10 dB, (further information is provided in Section 12: Traffic and Transport);

- Cardigan Street in Birmingham city centre, between Curzon Street and the B₄₁₁₄ Jennens Road, affecting the east façade of the Parkside Building (containing the Institute of Art and Design and the School of Media), the proposed new Birmingham City University buildings and the proposed mixed use Eastside Locks committed development on the boundary with Cardigan Street (CSV26-No8). An adverse effect is associated with a moderate increase in traffic noise levels of around 7dB on the southern half of Cardigan Street and a minor increase of around 4dB on the northern half, during the peak months following the permanent closure of a section of Park Street (further information is provided in Section 12: Traffic and Transport);
- Allison Street and the section of Coventry Street between Allison Street and Meriden Street in Birmingham city centre affecting various commercial premises (CSV26-N14). An adverse effect is associated with a moderate increase in traffic noise levels of around 7dB, during the peak months due to the localised re-routing of traffic to connect to/from New Canal Street (further information is provided in Section 12: Traffic and Transport);
- Bordesley Street in Birmingham city centre between New Canal Street and New Bartholomew Street affecting various adjacent commercial premises (CSV26-N15). A beneficial effect is associated with a moderate reduction in traffic noise levels of around 7dB due to the local re-distribution of traffic (further information is provided in Section 12: Traffic and Transport);
- Melvina Road between A₄₇ Saltley Road and B₄₁₃₂ Great Francis Street, in Nechells; and Adderley Road between Crawford Street and Ash Road, in Saltley (CSV26-N16). Various receptors on these streets, mainly consisting of commercial premises, but also including the Nechells Green Community Centre on Melvina Road and Adderley Children's Centre off Adderley Road are forecast to experience a minor increase in traffic noise levels of around 2dB due to localised re-routing of traffic (further information is provided in Section 12: Traffic and Transport); and
- Washwood Heath Road, between Aston Church Road and Adderley Road, in Washwood Heath (CS26-N17). Various receptors on this road, mainly consisting of commercial premises, but also including the Al-Huda school and the Madrasa Anjuman-I-Naqeeb-al-Islam community centre are forecast to experience a minor decrease in traffic noise levels of around 2dB, due to the localised re-routing of traffic (further information is provided in Section 12: Traffic and Transport).

Cumulative effects from the Proposed Scheme and other committed development

- 11.3.23 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments⁹⁴. In this area, it is not anticipated that there will be any developments built at the same time as the Proposed Scheme and accordingly, construction noise or vibration from the Proposed Scheme is unlikely to result in any significant cumulative noise effects.

Summary of likely residual significant effects

- 11.3.24 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it does not reach a level where it would significantly affect 84 residents.
- 11.3.25 The measures reduce any adverse effects from construction noise outdoors on the majority of residential communities such that they are not considered significant except at the residential communities in the following areas that are closest to the works:
- Drews Lane, Washwood Heath;
 - Warren Road, Common Lane, Pounds Green and Coronation Road, Washwood Heath;
 - Arley Road, Saltley;
 - Northumberland Street, Vauxhall;
 - A4540 Lawley Middleway, Vauxhall;
 - Penn Street, Etna Street and the Eastside Locks mixed-use development north of Curzon Street, Birmingham city centre; and
 - Bordesley Street and New Bartholomew Street, Birmingham city centre.
- 11.3.26 On a worst case basis, noise and/or vibration from specific construction activities has been identified as resulting in significant residual temporary effects on the following non-residential receptors:
- Leigh Junior, Infant and Nursery School and Hasanat College, Washwood Heath;
 - the Masjid Ali Project Mosque, Aston Church Road, Washwood Heath;
 - the closest commercial units in Saltley Business Park and Network Park industrial estate;
 - BCC Museum Collections Centre, Dollman Street;

⁹⁴ Refer to Volume 5: Appendix CT-004-000.

- various commercial and industrial premises to the north of the route between Erskine Street and A4540 Lawley Middleway, including the West Midlands Fire Service headquarters, Vauxhall;
- Safeside educational facility, Vauxhall;
- Professional Music Technology premises, A4540 Lawley Middleway;
- Millennium Point, the Institute of Art and Design, proposed new University buildings and the hotel within the Eastside Locks mixed use development, north of Curzon Street, Birmingham city centre;
- Hotel La Tour, B4100 Moor Street Queensway, Birmingham city centre;
- Carrs Lane Church and St Michael's Church, Carrs Lane, Birmingham city centre;
- Taboo Cinema, Park Street, Birmingham city centre; and
- the Polish Centre, Bordesley Street, Birmingham city centre.

11.3.27 Construction traffic, and the re-routing of existing traffic due to temporary and permanent road closures during the works, is likely to cause both significant adverse and significant beneficial effects on nearby residential and commercial premises. A number of roads in Washwood Heath, Vauxhall and Birmingham city centre are affected.

11.3.28 HS2 Ltd will continue to seek 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

Local assumptions – service pattern

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 One, and Phase One with Phase Two services are described in Volume 1⁹⁵. 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 14. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively

⁹⁵ The change in noise and vibration effects between the different passenger services is assessed in Volume 1

decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 14.

- 11.4.3 In addition to the passenger services there will be stock movements between Washwood Heath and Curzon Street at the start of the service day (from 05:00), at off-peak times during the day, and at the end of the service day (to 24:00).

Table 14: 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 Delta junction and Curzon Street station	07:00 – 21:00 hours	9 (3)	230kph with speeds decreasing close to Curzon Street station

Local assumptions – Washwood Heath depot

- 11.4.4 The Washwood Heath depot will operate throughout the day and night, but with the majority of operations occurring during the night. Night-time operations that generate noise will be reduced to a practical minimum. Passenger trains will be prepared and dispatched to Curzon Street station from approximately 05:00, before passenger services start each day at approximately 05:30. Trains will return to Washwood Heath depot during the evening as passenger services decrease on the operational railway, with the last train expected to arrive back from service at approximately 00:30. Trains will arrive at Washwood Heath depot during the night for routine inspections and maintenance. Trains will undergo planned maintenance (generally inside maintenance sheds) during the daytime. Trains requiring urgent, unplanned maintenance identified by that night's inspection will be undertaken overnight, if necessary.

Avoidance and mitigation measures

- 11.4.5 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities. These avoidance measures have protected many communities from likely significant noise or vibration effects.

Airborne noise

- 11.4.6 HS2 trains will be quieter than the relevant current European Union specifications. The track will be specified to reduce noise, as will the maintenance regime. Further information is provided in Volume 5: Appendix SV-001-000.
- 11.4.7 The Proposed Scheme incorporates 'low-level' barriers into the design of viaducts.
- 11.4.8 Significant noise effects from the operational static sources such as mechanical ventilation at stations 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).
- 11.4.9 The Washwood Heath depot site will be planned to reduce noise effects at adjacent receptors. Mitigation will include: limiting the sounding of train horns; control of noise from train movements along tightly curved tracks including wheel squeal; control of train equipment such as heating, ventilation and air-conditioning (HVAC) units while

vehicles are stabled; control of noise from maintenance and cleaning through the design of the maintenance sheds; enclosures for the carriage wash and wheel lathe; and boundary noise barriers as necessary.

Ground-borne noise and vibration

- 11.4.10 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

- 11.4.11 The mitigation measures including noise insulation will reduce noise inside all dwellings such that it will not reach a level where it would significantly affect residents.

Residential receptors: direct effects – communities

- 11.4.12 The mitigation measures in this area will avoid airborne noise adverse effects on the majority of receptors, and at the following communities:
- Washwood Heath;
 - Nechells;
 - Vauxhall;
 - Nechells Green;
 - Digbeth; and
 - Central Birmingham around Curzon Street.
- 11.4.13 Taking account of the envisaged mitigation, Volume 2: Map Series SV-05 shows the long term 40dB⁹⁶ night-time sound level contour from the operation of trains on the Proposed Scheme. The extent of the 40dB night-time sound level contour is equivalent to, or slightly larger than, the 45dB daytime contour⁹⁷.
- 11.4.14 In general, below 40dB during the night and 50dB during the day adverse effects are not expected.
- 11.4.15 Above 40dB during the night and 50dB during the day the effect of noise is dependent on the baseline sound levels in that area and the change in sound level (magnitude of effect) brought about by the Proposed Scheme. The airborne noise impacts and effects forecast for the operation of the scheme are presented on Volume 2: Map Series SV-05.

⁹⁶ Defined as the equivalent continuous sound level from 23:00 to 07:00 or LpAeq,night).

⁹⁷ With the train flows described in the assumptions section of this CFA Report, the daytime sound level (defined as the equivalent continuous sound level from 07:00 to 23:00 or LpAeq,day) from the Proposed Scheme would be approximately 5dB higher than the night-time sound level. The 40dB night-time contour therefore indicates the distance from the Proposed Scheme at which the daytime sound level would be 45dB. This differs from other CFA reports (where the difference is 10dB) because of the empty stock movements that occur between Curzon Street and Washwood Heath RSMD just prior to and just after the start and close of passenger services.

- 11.4.16 The changes in noise levels are likely to affect the acoustic character of the area such that there is a perceived change in the quality of life and are considered to be significant when assessed on a community basis⁹⁸ taking account of the local context⁹⁹. When assessed on this basis, none of the adverse effects on acoustic character in this area are considered significant.

Residential receptors: indirect effects

- 11.4.17 Changes in road traffic due to the Proposed Scheme, as set out in Section 12: Traffic and transport, are likely to cause adverse noise effects on residential receptors along the following local roads:
- New Bartholomew Street (OSV26-Co1), where an overall increase in outdoor noise levels of around 3dB is forecast; and
 - the section of Allison Street between Bordesley Street and B4100 Digbeth (OSV26-Co2), where an overall increase in outdoor noise levels of around 4dB is forecast.
- 11.4.18 These increases in noise level resulting from the changes in road traffic are likely to adversely affect the acoustic character of the area such that there is a perceived change in the quality of life. These effects have been considered significant when assessed on a community basis taking account of the local context¹⁰⁰.
- 11.4.19 Changes in road traffic due to the Proposed Scheme, as set out in Section 12: Traffic and transport, are likely to cause beneficial noise effects on residential receptors along the following local roads:
- Bordesley Street between Park Street and New Canal Street (OSV26-Co3), a reduction in road traffic noise levels of over 10dB is forecast; and
 - Fazeley Street west of New Bartholomew Street (OSV26-Co4). Closure of this road will reduce the road traffic noise levels on this route and provide a significant beneficial effect on committed development ref. CFA26/16.
- 11.4.20 These reductions in noise level resulting from the changes in road traffic are likely to beneficially affect the acoustic character of the area such that there is a perceived improvement in the quality of life. These effects have been considered significant when assessed on a community basis taking account of the local context¹⁰¹.

Non-residential receptors: direct effects

- 11.4.21 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

- 11.4.22 On a reasonable worst case basis, the assessment of operational noise and vibration indicates that a significant indirect noise effect is likely to occur on non-residential

⁹⁸ Further information is contained in Volume 1.

⁹⁹ Further information is provided in SV-001-000 and SV-004-026.

¹⁰⁰ Further information is provided in SV-001-000 and SV-004-026.

¹⁰¹ Further information is provided in SV-001-000 and SV-004-026.

receptors on Cardigan Street, between Jennens Road and Curzon Street due to increased road traffic noise levels of approximately 5dB (further information on traffic flows is provided in Section 12: Traffic and transport). Although there are currently no noise-sensitive receptors in close proximity to this road, this may be changed by the committed developments ref. CFA26/9, CFA26/10 and CFA26/12 (see Volume 5: Appendix CT-004-000).

12 Traffic and transport

12.1 Introduction

- 12.1.1 This traffic and transport 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 Washwood Heath to Curzon Street area.
- 12.1.2 With regard to traffic and transport, the main issues are increased traffic as a result of the construction and operation of the Proposed Scheme, road diversions, temporary and permanent road closures and temporary and permanent diversions and realignments of footways, particularly around the proposed Curzon Street station and in the Washwood Heath area as a result of the railway construction and the proposed Washwood Heath depot. The Proposed Scheme will also increase rail capacity, reduce rail journey times, reduce crowding and increase frequencies on existing rail services.
- 12.1.3 A detailed report on traffic and transport and surveys undertaken within the area is contained in Volume 5: Appendix TR-001-000, Transport Assessment.
- 12.1.4 Figure 2 shows the location of the key transport infrastructure in this area
- 12.1.5 The effects on traffic and transport are assessed quantitatively, based on baseline traffic conditions and future projection scenarios.
- 12.1.6 Engagement has been undertaken with the key transport authorities, including Birmingham City Council (BCC), Centro (the West Midlands Integrated Transport Authority), the Highways Agency (HA), Network Rail and the Canal and River Trust (CRT).

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, 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 A4040 Bromford Lane, A47 Heartlands Parkway/Nechells Parkway, A4540 Dartmouth Middleway/Lawley Middleway/Watery Lane Middleway, A38(M) Aston Expressway/St. Chads Queensway, B4114 Park Street/Jennens Road/Saltley Viaduct/Washwood Heath Road, B4132 Duddeston Mill Road/Great Francis Street/Vauxhall Road, B4145 Adderley Road, B4100 Moor Street Queensway and unclassified roads in the vicinity of the proposed Curzon Street station, Washwood Heath depot and the route. This includes Curzon Street, New Canal Street, Wolseley Drive and Aston Church Road. The main vehicular access to the Washwood Heath depot will be via Wolseley Drive off the A4040 Bromford Lane, and the main vehicular access to the proposed Curzon Street station will be via Curzon Street off the A4540 Lawley Middleway.

- 12.2.3 A number of transport modelling tools have been used to inform the assessment including the West Midlands regional transport model¹⁰², PRISM (Policy Responsive Integrated Strategy Model) for future forecast road traffic growth in the city centre area, and the Birmingham City Centre Model (SATURN) for future forecast traffic flows in the area around the proposed Curzon Street station. The Department for Transport's traffic forecasting tool, Trip End Model Presentation Program (TEMPO)¹⁰³ has been used to inform the assessment for future forecast road traffic growth in the Washwood Heath area.
- 12.2.4 The assessment covers the morning (08:00-09:00) and evening (17:00-18:00) peak periods for an average weekday.
- 12.2.5 Forecast future year traffic flows with and without the Proposed Scheme in the Washwood Heath area have been based on an approach that does not take account of wider effects, such as the redistribution and reassignment of traffic, modal shift and peak spreading. As a consequence, adverse traffic effects may be over-estimated.

12.3 Environmental baseline

Existing baseline

- 12.3.1 Existing conditions in the West Midlands have been determined through site visits, specially commissioned traffic and transport surveys and liaison with West Midlands Transport Authorities and stakeholders to source transport models, information on public transport, public rights of way (PRoW) and accident data.
- 12.3.2 Traffic surveys of all roads crossing the route or potentially affected were undertaken in June 2012 and June 2013, comprising junction turning counts and queue surveys, automatic traffic counts, automatic number plate recognition surveys, and parking accumulation surveys. This was supplemented by traffic and transport data obtained from other sources where available, including from BCC, Centro and the regional and local transport models. The highway peak hours in the study area were 08:00-09:00 and 17:00-18:00 hours.
- 12.3.3 Surveys of pedestrian and cyclist movements were undertaken in August and September 2012 to establish the nature of the PRoW and their usage by non-motorised users (pedestrians, cyclists and equestrians). Further surveys were undertaken in June 2013 at locations that were affected by the construction of Eastside City Park in 2012. The surveys included all PRoW and roads that will cross the route of the Proposed Scheme, and any additional PRoW and roads that will be affected by the Proposed Scheme. The Proposed Scheme affects 19 roadside footways, six footpaths and one PRoW within the Washwood Heath to Curzon Street area. The routes with the greatest usage were Fazeley Street to the west of Bartholomew Street, with around 1,600 users per day, the B4114 Park Street to the south of Fazeley Street, with around 650 users per day, and the footpath across Park Street Gardens between Fazeley Street and the B4114 Park Street with around 600 users per day.

¹⁰² PRISM; www.prism-wm.com; Accessed: June 2013.

¹⁰³ Department for Transport; www.gov.uk/government/publications/tempro-downloads; Accessed: June 2013.

- 12.3.4 There are several strategic routes that pass through the area. The M6 crosses the area in the north, and is accessed from junction 6 via the A38(M) Aston Expressway. The A38(M) Aston Expressway is the main route from the north into the city, and connects with the A4540 Dartmouth Middleway. The A4540 Dartmouth Middleway/Lawley Middleway/Water Lane Middleway is routed from north to south through the area, and intersects with the A47 Heartlands Parkway, A45 Small Heath Highway and A34 Stratford Road. The A47 Heartlands Parkway routes from south-east to north-west and connects with the A4040 Bromford Lane in Washwood Heath. The A45 Small Heath Highway heads east towards Coventry, and the A34 Stratford Road heads south-east. The strategic road network, particularly in and around Birmingham city centre is busy at peak times and delays can be experienced.
- 12.3.5 The main local roads affected by the Proposed Scheme in the Washwood Heath area are the B4114 Washwood Heath Road/Saltley Viaduct, Aston Church Road, B4132 Duddeston Mill Road and Wolseley Drive. The main local roads affected in the vicinity of the proposed Curzon Street station are Curzon Street, New Canal Street, the B4114 Park Street and the B4100 Moor Street Queensway. The local road network generally operates more efficiently than the strategic road network, although delays can be experienced.
- 12.3.6 Relevant accident data for the road network subject to assessment has been obtained from BCC for the three year period of 2009 to 2011. This has been assessed and no significant accident clusters were identified in the area.
- 12.3.7 The site for the proposed Curzon Street station is bounded to the west by the B4100 Moor Street Queensway, which is one of six bus interchanges that were implemented during 2012 as part of the Birmingham City Centre Interchange scheme. This scheme has significantly improved bus/rail interchange around the city centre.
- 12.3.8 Over 50 bus routes are accessible within close proximity of the proposed station, with most services operating at a high frequency throughout the day and at weekends. The proposed Curzon Street station is therefore highly accessible by bus from across Birmingham and the West Midlands.
- 12.3.9 National and local rail services are accessible via Birmingham New Street, Birmingham Moor Street and Birmingham Snow Hill railway stations, which are located in Birmingham city centre within close proximity of the proposed Curzon Street station. The closest railway station is Birmingham Moor Street, which is located at the south-west corner of the proposed Curzon Street station.
- 12.3.10 The Proposed Scheme crosses 19 roadside footways, six footpaths and one PRow in the area. The roadside footways include Aston Church Road, the B4114 Saltley Viaduct and the B4132 Duddeston Mill Road in the Washwood Heath area, Lawley Middleway and several roads in the area around the proposed Curzon Street station. The Proposed Scheme also crosses the footpath within Park Street Gardens between Fazeley Street and the B4114 Park Street. The one PRow is not currently accessible, and connects Common Lane to Bromford Island, crossing the proposed Washwood Heath depot site.

- 12.3.11 There are pedestrian footways on all of the routes that will form the immediate links to the proposed Curzon Street station, including the B4114 Jennens Road to the north, Digbeth to the south and the B4100 Moor Street Queensway to the west. Generally, formal pedestrian crossings are provided along the pedestrian desire lines, including several crossings on the B4100 Moor Street Queensway between the proposed Curzon Street station site, the Bullring and the city centre area. The Eastside City Park, which opened in December 2012, has enhanced local pedestrian and cycle links.
- 12.3.12 National Cycle Network (NCN) Route 53 runs generally from north to south through the area, and is a traffic free cycle route. In the vicinity of the proposed Curzon Street station, there are several advisory cycle routes on Curzon Street, Cardigan Street and New Canal Street, as well as a signed route on Fazeley Street, and off-road routes including the Digbeth Branch Canal and links to Birmingham city centre. In the vicinity of the proposed Washwood Heath depot there is a network of advisory cycle routes, including Drews Lane and Bromford Road, and an off-road cycle route around Bromford Island, which connects to the north.
- 12.3.13 The Digbeth Branch Canal forms the primary waterway passing through the study area. This links with the Birmingham and Fazeley Canal at Aston Junction and the Grand Union Canal.

Future baseline

- 12.3.14 Future baseline traffic volumes for the years of assessment 2021, 2026 and 2041 have been derived for the Birmingham city centre area from PRISM and the Birmingham City Centre Model and this includes allowance for planned developments in the city centre area. There are planned infrastructure improvements at junctions on the A4540 Lawley Middleway, including at Ashted Circus, Curzon Circle and Bordesley Circus, which have also been included in the future baseline scenarios.
- 12.3.15 There are several existing planning consents for large scale development which will be directly affected by the proposed Curzon Street station. These include Curzon Park and Eastside City Park Gate. The forecast traffic flows with the Proposed Scheme have been adjusted to allow for these developments not coming forward.
- 12.3.16 Future baseline traffic volumes for the Washwood Heath area have been derived by applying growth factors based on TEMPRO.

Construction (2021)

- 12.3.17 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 around 15% in the Birmingham city centre area and 17% in the Washwood Heath area by 2021 compared to 2012.

Operation (2026)

- 12.3.18 Future baseline traffic volumes in the peak hours are forecast to grow by around 21% in the Birmingham city centre area and 28% in the Washwood Heath area by 2026 compared to 2012.

Operation (2041)

- 12.3.19 Future baseline traffic volumes in the peak hours are forecast to grow by around 39% in the Birmingham city centre area and 47% in the Washwood Heath area by 2041 compared to 2012.

12.4 Effects arising during construction**Avoidance and mitigation measures**

- 12.4.1 The following measures (as described 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:
- creation of a haul road running east to west from the A4040 Bromford Lane to the A4540 Lawley Middleway and at the proposed Curzon Street station site;
 - construction materials and equipment will be transported along the haul road adjacent to the Proposed Scheme alignment, where reasonably practicable, to reduce lorry movements on the public highway;
 - offline construction of new road infrastructure on Aston Church Road to reduce disruption;
 - restricting road closures to overnights and weekends where reasonably practicable;
 - temporary alternative routes for footways including the Digbeth Branch Canal towpath;
 - Heavy goods vehicles (HGV) routeing, as far as reasonably practicable, along the strategic road network, and using designated routes for access, as shown on Volume 5: Maps TR-03-158b to TR-03-160;
 - materials processing area will be located in the vicinity of the Bromford tunnel west portal (central) compound to process demolition material for reuse, which will reduce the lorry movements on the public highway;
 - maintenance or re-provision of access to properties and businesses adjacent to the Proposed Scheme;
 - provision of off-site worker accommodation in the Birmingham Interchange and Chelmsley Wood area (CFA24), with the potential for shared multi-occupancy travel between the accommodation and the compounds in this area; and
 - provision of on-site welfare facilities to reduce daily travel by site workers.
- 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 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 alternative modes of transport or vehicle sharing. This will be supported by an over-arching framework travel plan¹⁰⁴ 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 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 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 the construction of the Proposed Scheme on or adjacent to public roads, bridleways, footpaths and other PRow affected by the Proposed Scheme, as necessary.
- 12.4.5 Specific measures will include:
- core site operating hours will be 08:00 to 18:00 on weekdays and 08:00 to 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 (draft CoCP, Section 5). However, sites associated with tunnelling works (i.e. Bromford tunnel west portal (east) main compound) will be operational 24 hours a day. It is anticipated that shift changeover times would not coincide with the highway peak hours; and
 - excavated material will be reused wherever reasonably practicable along the route of the Proposed Scheme, which will reduce the effects of construction vehicles on the public highway (draft CoCP, Section 15).
- 12.4.6 Where works potentially affect Network Rail assets, disruption to travelling passengers and freight movements will be minimised as far as possible. This will include measures such as:
- programming works to coincide with possessions that are required and planned for the general maintenance of the railway;
 - planning the required works so that they can be undertaken in short overnight stages when passenger services are not disrupted; and
 - programming longer closures at the weekend and on bank holidays to minimise the number of passengers affected.

¹⁰⁴ 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.

Assessment of impacts and effects

Temporary effects

- 12.4.7 The following section considers the impact on traffic and transport and the consequential effects resulting from construction of the Proposed Scheme.
- 12.4.8 The temporary traffic and transport impacts within this area will include:
- construction vehicle movements to and from the various worksites;
 - road closures and associated diversions;
 - displacement of parking and loading; and
 - alternative routes for footways and footpaths.
- 12.4.9 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.
- 12.4.10 Details of construction compounds are provided in Section 2. The duration of when there will be busy transport activity at each compound is shown in Table 15. This represents the periods when the construction traffic flows will be greater than 50% of the peak month flows. The estimated number of daily vehicle trips during the operation of each compound is shown, the lower end of the range shows the average number of trips in the busy period and the upper end shows 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 15: Typical vehicle trip generation for construction compounds in this area

Compound Type	Compound Name	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Main compound	Bromford tunnel west portal (east)	A4040 Bromford Lane, Wolseley Drive	Q2 2017	5 years and 9 months	23	176 – 220	290 – 500
Satellite compound	Bromford tunnel west portal (central)	A47 Heartlands Parkway, bridge over railway	Q2 2017	5 years and 9 months	36	104 – 130	130 – 160
Satellite compound	Bromford tunnel west portal (west)	Aston Church Road, access road to local businesses	Q2 2017	5 years and 9 months	26	104 – 130	120 – 122
Satellite compound	Aston Church Road overbridge	A47 Heartlands Parkway	Q2 2017	5 years and 3	1	24 – 30	<10 – <10

Compound Type	Compound Name	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
	(west)			months			
Satellite compound	Aston Church Road overbridge (east)	Aston Church Road, Arley Road	Q2 2017	4 years and 6 months	7	16 – 20	23 – 37
Satellite compound	B4114 Saltley viaduct (west)	A47 Heartlands Parkway	Q1 2018	2 years	2	16 – 20	95 – 100
Satellite compound	B4114 Saltley viaduct (east)	B4114 Saltley Viaduct, Pennine Way	Q2 2017	3 years	8	24 – 30	129 – 140
Satellite compound	Curzon Street No. 1 viaduct	Duddeston Mill Road	Q2 2017	5 years and 9 months	20	48 – 60	18 – 25
Satellite compound	Curzon Street No. 2 viaduct	Erskine Street	Q2 2017	2 years and 9 months	3	16 – 20	20 – 31
Satellite compound	Curzon Street No. 3 viaduct	Curzon Street	Q2 2017	3 years	3	40 – 50	80 – 102
Main compound	Curzon Street station	Curzon Street	Q2 2017	5 years and 9 months	18	120 – 150	29 – 40

- 12.4.11 Information on the indicative construction programme and methodology is provided in Section 2.3. Works will include watercourse diversions, utilities diversions, earthworks, viaduct, bridge, tunnel, tunnel portal, depot and station construction. The peaks in activity at individual compounds, based on the scope, scale and programme of works are not expected to occur simultaneously at compounds as the peak of activity for individual compounds rarely overlaps.
- 12.4.12 Month 27 represents the peak month of activity when 10 of the 11 compounds will be operating, including when the Bromford tunnel west portal worksites will be at their busiest. The Bromford tunnel west portal worksites contribute approximately 90% of the total flow in this month.
- 12.4.13 The construction compounds will also be the main location for advance works including utilities. The advance works (including utilities) and rail installation works,

that will follow on after the civil engineering work, will be of a lower intensity and will generate a lower level of HGV activity.

- 12.4.14 The construction assessment considers the traffic and transport impacts and effects in three peak months of construction activity, based on the proposed phasing of the works. The peak months have been identified as Months 22 (2018 Quarter 4), 27 (2019 Quarter 1) and 36 (2019 Quarter 4). In Month 22 there will be nine operational worksites, and in both Months 27 and 36 there will be ten worksites in operation. The construction assessment considers average construction traffic levels for the peak months and outside of these peaks activity is expected to be lower for much of the time. In considering the effects of the Proposed Scheme, where these occur in particular months assessed this is identified. In general the effects are greatest in Month 27. The assessment of these three peaks in activity has been used to ensure that all significant effects are identified. Where impacts and effects occur in particular peak periods these are identified below. Where impacts relate to specific activities these are identified.
- 12.4.15 The construction assessments have also considered any impacts that arise from construction in the adjoining areas.
- 12.4.16 In the busiest month, there are estimated to be approximately 1,680 vehicle movements (in/out) per day across the study area. The split of construction vehicles is expected to be 55% HGVs and 45% cars and light goods vehicles (LGV).
- 12.4.17 It is proposed that the M6, A38(M) Aston Expresssaway, A38 Tyburn Road, A4540 Lawley Middleway, A4040 Bromford Lane, A47 Heartlands Parkway and A45 Coventry Road will provide the primary HGV access and egress routes.
- 12.4.18 There will be closures of a number of roads within the area, including the following:
- weekend and overnight closures of Aston Church Road to construct a replacement Aston Church Road overbridge. The replacement bridge will be constructed offline to minimise disruption;
 - weekend and overnight closures on the B4132 Duddeston Mill Road, A47 Heartlands Parkway, A4540 Lawley Middleway and New Canal Street;
 - temporary closure of the B4114 Saltley Viaduct for 18 months, to construct a replacement bridge over the Proposed Scheme;
 - temporary closure of Viaduct Street for four years; and
 - permanent closure of the B4114 Park Street, Andover Street (north end), Banbury Street, Bartholomew Street, Fazeley Street (west of New Canal Street), Freeman Street and Seymour Street in order to construct the proposed Curzon Street station.
- 12.4.19 Weekend and overnight closures are not expected to have a significant effect on traffic flows and delays to vehicle occupants as a result of diversions.
- 12.4.20 It is not expected that the construction worker traffic on its own will have a significant effect on congestion and delays, as site workers will generally arrive and depart outside the weekday morning and evening peak hours.

- 12.4.21 However, construction of the Proposed Scheme will result in changes in daily traffic flows due to workers and construction vehicles accessing compounds, as well as the diversion of traffic due to the temporary closure of the B4114 Saltley Viaduct and the permanent closures, in particular the closure of the B4114 Park Street.
- 12.4.22 The closure of the B4114 Saltley Viaduct will result in the re-routing of 1,759 vehicles in the morning peak hour and 1,983 vehicles in the evening peak hour. Vehicles currently using the B4114 Saltley Viaduct have been assumed to re-route onto the B4132 Duddeston Mill Road and Aston Church Road. The closure of the B4114 Park Street will result in the re-routing of 1,077 vehicles in the morning peak hour and 1,085 vehicles in the evening peak hour. The majority of vehicles on the B4114 Park Street will re-route onto the A4540 Lawley Middleway and the B4100 Moor Street Queensway.
- 12.4.23 Changes in peak hour traffic flows as a result of construction traffic, and the temporary closure of the B4114 Saltley Viaduct, will lead to a significant temporary adverse effect on congestion¹⁰⁵ and delays in Months 22, 27 and 36, at the following junctions:
- A47 Heartlands Parkway/Aston Church Road (minor adverse effect);
 - B4114 Washwood Heath Road/Aston Church Road (major adverse effect);
 - B4145 Adderley Road/B4132 Duddeston Mill Road (major adverse effect); and
 - B4132 Duddeston Mill Road/B4132 Melvina Road (major adverse effect).
- 12.4.24 Changes in peak hour traffic flows as a result of construction traffic and the closures in Birmingham city centre, in particular the closure of the B4114 Park Street, will lead to a significant effect on congestion and delays in Months 22, 27 and 36, at the following junctions:
- B4100 Moat Lane/Upper Dean Street (moderate adverse effect);
 - Sherlock Street/Wrentham Street (moderate adverse effect);
 - B4100 High Street Deritend/Heath Mill Lane (minor adverse effect);
 - Camp Hill Circus (moderate adverse effect); and
 - Woodcock Street/Aston Street (minor adverse effect).
- 12.4.25 These effects will be reduced once the highway capacity improvements proposed as part of the operational phase are implemented during the construction phase.
- 12.4.26 The temporary closure of the B4114 Saltley Viaduct will result in traffic being diverted via alternative routes, and it is expected that this will increase the journey distance by

¹⁰⁵ 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 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.

approximately 1.75km. The diversion will have a moderate adverse effect in extending travel distances.

- 12.4.27 The Proposed Scheme includes the following permanent road closures and the direct results of these are reported in Section 12.5 along with other long-term operational impacts:
- closure of the B₄₁₁₄ Park Street is likely to result in a diversion of between 200m and 1.2km depending on which direction is travelled; and
 - closures on Andover Street, Banbury Street, Bartholomew Street, Fazeley Street (west of New Canal Street), Freeman Street and Seymour Street, which mainly provide access to areas that will be displaced as part of the development.
- 12.4.28 The B₄₁₁₄ Saltley Viaduct closure, will lead to significant effects on severance¹⁰⁶ for non-motorised users due to increases in overall daily traffic flows in Months 22, 27 and 36, at the following locations:
- B₄₁₄₅ Adderley Road, between the B₄₁₃₂ Duddeston Mill Road and the B₄₁₁₄ High Street/Saltley Viaduct (moderate adverse effect); and
 - B₄₁₃₂ Melvina Road (moderate adverse effect).
- 12.4.29 Changes in overall daily traffic flows, mainly as a result of the B₄₁₁₄ Park Street closure, will lead to a minor adverse effect in increasing travel distances for non-motorised users in Months 22, 27 and 36, at the following locations:
- The Priory Queensway;
 - Cardigan Street; and
 - Bordesley Street, between Meriden Street and Oxford Street.
- 12.4.30 Changes in daily traffic flows, as a result of HGV construction traffic, will lead to a significant effect in increasing travel distances for non-motorised users in Months 22, 27 and 36, at the following locations:
- Curzon Street (moderate adverse effect); and
 - New Canal Street (minor adverse effect).
- 12.4.31 The construction works will require temporary traffic management measures where new highway infrastructure is required, in particular around the proposed Curzon Street station. This is likely to result in some reduction in highway capacity and delays, but the impacts of these are not expected to be significant.
- 12.4.32 Utilities works (including diversions) have been assessed in detail where they are major works and where the traffic and transport impacts from the works separately,

¹⁰⁶ 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.

or in combination with other works, is greater than other construction activities arising from such works within the area. More minor utilities works are expected to result in only localised traffic and pedestrian diversions that will be of short term duration. No additional significant effects from these works are expected.

12.4.33 There will be a temporary loss of car parking at several locations along the route. This includes a loss of private off-street car parking spaces and designated car parking spaces. This will have a significant effect at the following locations:

- West Midlands Fire Service, located on St. James' Place (major adverse effect, resulting from the loss of 146 (up to 58%) parking spaces;
- Betrex, located to the east of Dollman Street (major adverse effect, resulting from the loss of approximately 20 (around 55%) unmarked parking spaces);
- Howell Group/CRH Transport Training Ltd, located on Alma Crescent (major adverse effect, resulting from the loss of approximately 15 (around 38%) unmarked parking spaces);
- Network Rail Signal Centre, located on the B4132 Duddeston Mill Road (moderate adverse effect, resulting from the loss of 26 (around 47%) parking spaces);
- Mainstream Industrial Park, located on Mainstream Way (major adverse effect resulting from the loss of approximately 20 (around 26%) unmarked parking spaces); and
- Lookers, located adjacent to the A47 Heartlands Parkway/B4137 Cuckoo Road junction (major adverse effect resulting from the loss of approximately 190 (around 81%) marked/unmarked parking spaces including staff, customer and sales parking).

12.4.34 Construction of the Proposed Scheme will also lead to a loss of parking that will be permanent at the following locations:

- On-street pay and display parking on Fazeley Street;
- Curzon Street pay and display car park;
- Seymour Street pay and display car park;
- Albert Street surface level pay and display car park;
- Freightliner Terminal Depot, located on Landor Street;
- Cosway (UK) Ltd, located on Network Park; and
- Salts Medilink Distribution Centre, located on Network Park.

12.4.35 These impacts are considered in Section 12.5.

12.4.36 There are other locations, where off-street car parking will be lost, but the businesses associated with the car parking spaces will be displaced to facilitate the Proposed

Scheme and, therefore, the need for these spaces will not exist. No significant parking effects will therefore arise.

- 12.4.37 There will be a significant temporary loss of two disabled car parking spaces at the Network Rail Signal Centre (major adverse effect).
- 12.4.38 There will be a significant temporary loss of loading bays at the following locations:
- Birmingham City Council Museum Collection Centre, located on Dollman Street (major adverse effect due to the loss of three (100%) loading bays);
 - Howell Group/CRH Transport Training Ltd (major adverse effect due to the loss of approximately ten (likely to be 100%) unmarked HGV parking bays);
 - Crown International, located on Landor Street (major adverse effect due to the loss of approximately 68 (around 45%) marked/unmarked HGV parking bays); and
 - West Midlands Fire Service (major adverse effect due to the loss of four (100%) loading bays).
- 12.4.39 HS2 Ltd will work with businesses affected to identify opportunities where reasonably practical to mitigate effects on parking by the use of land acquired for the Proposed Scheme. Where this is possible alternative provision will mitigate these parking effects.
- 12.4.40 The effect on accident and safety risks will not be significant. There are no locations where there are existing highway safety issues and where there will be substantial increases in traffic during construction.
- 12.4.41 Construction of the Proposed Scheme will result in a number of temporary bus diversions. The temporary closure of the B4114 Saltley Viaduct will result in the diversion of bus routes either via Aston Church Road or the B4132 Duddeston Mill Road (subject to the headroom restriction). The diversion will, depending on the bus route, increase the journey distance by up to 1.5 km. The diversion will be a moderate adverse effect on ten bus routes (14, 53, 55, 55A, 56, 72, 8A, 8C, 90 and AH5) and a major adverse effect on one bus route (94), due to the high frequency of this service.
- 12.4.42 The temporary closure of the B4114 Saltley Viaduct is expected to result in the temporary relocation of up to five bus stops. The relocation of the bus stops will have a minor adverse effect on the users of two bus routes (8A and 8C), a moderate adverse effect on the users of seven bus routes (14, 53, 55, 55A, 56, 72, 90 and AH5), and a major adverse effect on the users of one bus route (94).
- 12.4.43 The closure of the B4114 Park Street will result in seven bus routes (17, 58, 59, 60, 97, 900, 957) being diverted permanently via the B4100 Moor Street Queensway, and the relocation of two bus stops. The significant permanent effects are reported in section 12.5.
- 12.4.44 Rail possessions will be required within this area and the adjoining Castle Bromwich and Bromford area (CFA25). Disruption to rail users will be minimised by limiting possessions, where reasonably practical, to overnight, off-peak or weekend periods,

although there will be one possession that will affect a lightly used freight line and will last for seven days There are not expected to be any significant effects on the travelling public or freight from rail possessions or blockades in this area. Where necessary, rail replacement services will be provided.

- 12.4.45 The construction of the Proposed Scheme will result in temporary minor adverse effects on two roadside footways (St. James' Place and Lawford Close) and one footpath (alongside Digbeth Branch Canal), and major adverse effects on two roadside footways (B4114 Saltley Viaduct and B4132 Duddeston Mill Road). These adverse effects will result from additional walking distances arising from closures or alternative routes. Five of these will increase walking distances by more than 500m: the B4114 Saltley Viaduct (1.4km), Duddeston Mill Road (1.4km), St James Place (640m), Lawford Close (630m), and the Digbeth Branch Canal (850m).
- 12.4.46 There will also be permanent impacts on footways and footpaths in the following locations:
- Viaduct Street;
 - footpath (informal trodden path) across the grassed area between Banbury Street and Bartholomew Street;
 - Banbury Street;
 - Bartholomew Street;
 - Fazeley Street;
 - B4114 Park Street; and
 - the footpath across Park Street Gardens between Fazeley Street and the B4114 Park Street).
- 12.4.47 These permanent impacts are considered in Section 12.5.
- 12.4.48 The construction of the Proposed Scheme is likely to require only temporary weekend or overnight closures of the Digbeth Branch Canal. The effect on canal users will not therefore be significant.

Cumulative effects

- 12.4.49 The assessment includes cumulative effects of planned development during construction by taking this into account within background traffic growth.
- 12.4.50 The assessment also includes in-combination effects by taking into account traffic and transport impacts of works being undertaken in the Coleshill Junction area (CFA19), Balsall Common and Hampton-in-Arden area (CFA23), Birmingham Interchange and Chelmsley Wood area (CFA24) and Castle Bromwich and Bromford area (CFA25). Daily construction traffic flows of up to 829 cars/LGV and up to 120 HGVs, as generated from compounds in the adjacent CFAs, have been assigned across various routes in this area.

Permanent effects

- 12.4.51 Any permanent effects of construction have generally been considered in the operations phase assessments for traffic and transport, see 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 operational phase need to be considered together. However, the effect on general traffic flows due to diverted traffic from the planned road closure at the B4114 Park Street, which is part of the permanent scheme, has been considered in the assessment of construction impacts and effects, due to its interaction with temporary road closures.

Other mitigation measures

- 12.4.52 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 the adverse effects may be over-stated.
- 12.4.53 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered necessary, based on the outcomes of this assessment.

Summary of likely significant residual effects

- 12.4.54 The most intensive peak periods of construction will cause increases in traffic which will from time to time cause additional congestion and/or increase delays for road users at the junctions of the A47 Heartlands Parkway/Aston Church Road, B4114 Washwood Heath Road/Aston Church Road, B4145 Adderley Road/B4132 Duddeston Mill Road, B4132 Duddeston Mill Road/B4132 Melvina Road, B4100 Moat Lane/Upper Dean Street, Sherlock Street/Wrentham Street, B4100 High Street Deritend/Heath Mill Lane, Camp Hill Circus and Woodcock Street/Aston Street.
- 12.4.55 Similarly there will be a temporary increase in traffic that will affect pedestrians and cyclists crossing the B4145 Adderley Road, between the B4132 Duddeston Mill Road and B4114 High Street/Saltley Viaduct, the B4132 Melvina Road, Curzon Street, New Canal Street, The Priory Queensway, Cardigan Street and Bordesley Street, between Meriden Street and Oxford Street.
- 12.4.56 The temporary closure of Saltley Viaduct will increase journey times for road users and increase travel distances for non-motorised users due to the diversion required. There will also be increased journey times on eleven bus routes (8A, 8C, 14, 53, 55, 55A, 56, 72, 90, 94 and AH5) and bus stops will be relocated, which will extend the travel distance for some users of these bus stops.
- 12.4.57 There will be a temporary loss of car parking and/or loading areas at the West Midlands Fire Service, Crown International, Betrex, Howell Group/CRH Transport Training Ltd, Mainstream Industrial Park, the Network Rail Signal Centre, Lookers and the Birmingham Museum Collection Centre.

12.4.58 Four roadside footways (St James' Place, Lawford Close, B₄₁₁₄ Saltley Viaduct and B₄₁₃₂ Duddeston Mill Road) and the Digbeth Branch Canal towpath will be temporarily diverted and will extend journey times for pedestrians and cyclists.

12.4.59 The significant effects that result from construction of the Proposed Scheme are shown on Volume 5: Maps TR-03-158b to TR-03-160.

12.5 Effects arising from operation

Avoidance and mitigation measures

12.5.1 The following measures have been included as part of the design of the Proposed Scheme and will avoid or reduce impacts on transport users:

- the proposed Curzon Street station has been designed to include sufficient concourse and platform space to accommodate passenger growth to 2041 and beyond;
- the design of Curzon Street station includes the following transport facilities that will be sufficient to accommodate the forecast levels of use, as shown on Volume 5: Map TR-01-005:
 - dedicated taxi facilities;
 - dedicated pick-up and drop-off facilities, comprising a 'kiss and ride' drop-off area and short stay car parking. There is no long stay car parking included as part of the station design, as it is expected that the majority of rail passengers will access the station via drop off (taxi and kiss and ride), public transport or walking. Any passengers that do want to park will be able to use the existing Birmingham city centre car parks located close to the station;
 - pedestrian and cycle facilities;
 - pedestrian link to Moor Street station; and
 - servicing and delivery facilities.
- the realignment of New Canal Street and its conversion to one-way operation for traffic but maintaining all movement pedestrian and cycle access;
- upgraded highway capacity including improvements to the Curzon Street/Cardigan Street junction and the Curzon Circle and Garrison Circus junctions on the A₄₅₄₀ Lawley Middleway;
- provision of replacement access to Birmingham Gun Barrel Proof House, which is currently accessed from Banbury Street;
- a replacement overbridge at Aston Church Road;
- a replacement of the B₄₁₁₄ Saltley Viaduct;
- a new bridge over the Stechford and Aston line – the Washwood Heath rail overbridge;

- a new viaduct over the Birmingham and Derby line, Birmingham and Bushbury line, A4540 Lawley Middleway and Digbeth Branch Canal; and
- Washwood Heath depot that will operate on a 24hour shift basis with changeover times unlikely to coincide with the highway peak hours.

12.5.2 Operational station and depot travel plans will be used to mitigate the impacts of traffic and transport movements associated with the maintenance and operation of the Proposed Scheme in this area. Travel plans will be implemented for both the proposed Curzon Street station and the Washwood Heath depot, and also to mitigate impacts associated with the station at Birmingham Interchange (CFA24).

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.

12.5.4 The operational traffic and transport impacts within this CFA will be:

- increase in rail capacity between London and Birmingham;
- reduced rail journey times between London and Birmingham;
- passenger demands to and from the proposed Curzon Street station;
- road closures, changes to street patterns and associated diversions around the proposed Curzon Street station, in particular the closure of the B4114 Park Street and the change from two-way to one-way southbound operation on New Canal Street;
- staff movements associated with the operation of the Washwood Heath depot;
- reduction in parking and loading at various locations along the route of the Proposed Scheme; and
- roadside footway and footpath diversions/realignments, particularly in the vicinity of the proposed Curzon Street station.

12.5.5 The forecast of total passenger demand, along with the number of people travelling by each mode of transport to/from Curzon Street station is shown in Table 16.

Table 16: Approximate Curzon Street station person trips per mode

Mode/ Demand	2026 (Phase 1)		2041 (Phase 2)	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
	Boarders/ Alighters	Boarders/ Alighters	Boarders/ Alighters	Boarders/ Alighters
Total HS2 Passengers	1,760	1,870	4,670	4,970
Car parked (long stay)	60	50	110	80
Car (kiss and ride)	50	40	90	80
Taxi	90	110	160	200
Bus	340	250	720	550
Walk/ Cycle	480	590	1,030	1,270
Other Trains	750	840	2,560	2,800

- 12.5.6 With the introduction of the Proposed Scheme in 2026, it is forecast that there will be approximately 1,760 passengers boarding, alighting and inter-changing at Curzon Street station in the morning peak hour and approximately 1,870 passengers boarding, alighting and inter-changing in the evening peak hour.
- 12.5.7 For 2041, with the full Phase 2 operation, it is forecast that these numbers increase to approximately 4,670 passengers using Curzon Street station in the morning peak hour and approximately 4,970 passengers in the evening peak hour through increased train frequency and additional national rail destinations.
- 12.5.8 The Proposed Scheme will generate significant major beneficial effects for rail passengers in the area in 2026 and 2041. They will benefit from an increase in rail capacity from the Proposed Scheme services and from significantly improved journey times between Birmingham and London, which is evidenced by the levels of use set out in Table 17 (with the introduction of Phase Two, the new links to Manchester and Leeds will result in substantial journey time and capacity benefits to these cities and intermediate stations, together with further opportunities to exploit released capacity to provide additional services and reduce crowding).
- 12.5.9 There will also be significant major beneficial effects to local commuters from released capacity on the existing rail network, including reduced crowding and the potential for additional services.
- 12.5.10 In 2026 and 2041 the primary benefits will be shorter journey times, increased reliability, reduced crowding, support for options for growth and increased access to wider national rail destinations.
- 12.5.11 The forecast of primary origins and destinations of the passengers boarding and alighting at Curzon Street station are shown in Table 17. These are expected to be broadly the same for both the morning and evening peak hours and for 2026 and 2041, with more than 40% of passengers travelling to/from Birmingham City Centre.

This distribution will influence the mode and routes used by passengers to gain access to the station.

Table 17: Primary origin and destination of trips boarding and alighting at Curzon Street station

Origins/ Destinations	2026 (Phase 1)		2041 (Phase 2)	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
	Boarders/ Alighters	Boarders/ Alighters	Boarders/ Alighters	Boarders/ Alighters
Birmingham city centre	42%	42%	42%	42%
Selly Oak/ Northfield	12%	12%	12%	12%
Erdington/ Sutton Coldfield/ Lichfield	9%	10%	9%	10%
Chad Valley	6%	6%	6%	6%
Bromsgrove/ Evesham/ Worcester	6%	6%	6%	6%

- 12.5.12 Over 40% of passengers using Curzon Street station in 2026 (increasing to over 50% in 2041) will use train services to access the station, with approximately two thirds interchanging with Birmingham New Street station and just under a third interchanging with Moor Street station.
- 12.5.13 The proposed Washwood Heath depot is forecast to generate approximately 780 vehicle movements per day. However, the weekday peak hour trip generation is expected to be low, the depot is expected to operate a shift pattern, with changeover times that do not coincide with the morning and evening peak periods on the local road network. Therefore, any traffic and transport impacts due to the depot will be during off-peak periods. In addition, the trips generated by the Washwood Heath depot are forecast to be less than those produced by the existing uses that will be displaced. The maintenance of the Proposed Scheme will generate limited vehicular trips and the effect will not be significant.
- 12.5.14 The Proposed Scheme includes the closure, realignment and/or reconfiguration of highways around Curzon Street station including the closure of the B4114 Park Street, Andover Street (north end), Banbury Street, Bartholomew Street, Fazeley Street (west of New Canal Street), Freeman Street, Seymour Street and Viaduct Street (partial) and the realignment and conversion of a section of New Canal Street from two-way to one-way operation (southbound). The other main roads that cross the Proposed Scheme, including the A4540 Lawley Middleway, B4132 Duddeston Mill Road, B4114 Saltley Viaduct and Aston Church Road will be retained.
- 12.5.15 Operation of the Proposed Scheme will result in changes in daily traffic flows due to staff and passengers accessing Curzon Street station, staff movements at the depot, as well as the road closures, in particular the B4114 Park Street closure, and the changed operation of New Canal Street. In 2026, the closure of the B4114 Park Street will result in the re-routing of 1,115 vehicles in the morning peak hour and 1,082 vehicles in the evening peak hour. This will stay broadly constant at 1,148 vehicles and 1,063 vehicles in the morning and evening peak hours respectively in 2041. The

majority of vehicles will re-route onto the A4540 Lawley Middleway and the B4100 Moor Street Queensway.

- 12.5.16 The configuration of the station access, off Curzon Street and New Canal Street, and patterns of origins and destinations shown in Table 17, results in the main flows, particularly relevant to traffic impacts, being towards the north, south and west. In 2026, there are around 240 station generated traffic movements in the morning and evening peak hours, and in 2041, around 440. Car and taxi access will represent just over 10% of the users of Curzon Street station in 2026 and will be under 10% in 2041. In relation to overall traffic movements in the area this is a small increase (no reduction in car and taxi access to Birmingham New Street station has been assumed, which will mean that the adverse traffic effects may be overstated).
- 12.5.17 The traffic changes are expected to result in additional pressure on the A4540 Lawley Middleway, in particular Curzon Circle and Garrison Circus. This section of the network will be under considerable pressure regardless of HS2, but HS2 increases this. The proposed works to Curzon Circle, Garrison Circus and the Curzon Street/Cardigan Street junction are designed to ensure that the Proposed Scheme will not, overall, have a detrimental impact on highway conditions.
- 12.5.18 The locations with increases in peak hour traffic flows and consequential adverse effects for non-motorised users in 2026 and 2041 on the road network local to Curzon Street station due to the combined impact of the re-configuration of the highway layout and traffic accessing Curzon Street station are:
- B4100 Moor Street Queensway – traffic flows will increase due to the closure of the B4114 Park Street in 2026 by up to 40% in the morning peak hour and by 48% in the evening peak hour, and in 2041 by 57% and 57% respectively. The increases are primarily southbound with the southbound flows expected to be similar to the northbound flows, which are largely unaffected by the scheme (minor adverse effect);
 - Curzon Street, between New Canal Street and Cardigan Street – traffic flows will increase in 2026 by around 89% in the morning peak hour and 27% in the evening peak hour, and in 2041 by 86% and 18% respectively (moderate adverse effect);
 - New Canal Street, between Fazeley Street and Curzon Street – traffic flows will increase in 2026 by around 43% in the morning peak hour and 99% in the evening peak hour, and in 2041 by 68% and 71% respectively (moderate adverse effect);
 - Cardigan Street – traffic flows will increase in 2026 by around 59% in the morning peak hour and 91% in the evening peak hour, and in 2041 by 53% and 55% respectively (minor adverse effect in 2026, moderate adverse effect in 2041);
 - Floodgate Street, between Fazeley Street and Moore's Row – traffic flows will increase in 2026 by up to 58% in the morning peak hour and 39% in the evening peak hour, and in 2041 by 73% in the morning peak hour (minor adverse effect);

- Oxford Street, between Coventry Street and the B4100 High Street Deritend – traffic flows will increase in 2026 by around 49% in the evening peak hour and in 2041 by 12% and 45% in the morning and evening peak hours (minor adverse effect);
- Heath Mill Lane, between the B4100 High Street Deritend and Alcock Street – traffic flows will increase in 2041 by around 12% in the morning peak hour and 6% in the evening peak hour (minor adverse effect in 2041); and
- Great Barr Street, between Derby Street and Fazeley Street – traffic flows will increase in 2041 by up to around 12% in the morning peak hour and 15% in the evening peak hour (minor adverse effect in 2041).

- 12.5.19 The increases in peak hour traffic flows show the impact that the closure of the B4114 Park Street, and re-configured New Canal Street, has on the B4100 Moor Street Queensway. This is in part due to the relatively low background traffic flows on this road. By contrast, the increase in traffic flows on the A4540 Lawley Middleway, which will be the other primary north/south route that will be affected by the closure, and will be the primary access route to the station, is below 10% due to the higher background traffic flows.
- 12.5.20 To mitigate the effects on congestion and delays, improvement works are proposed on the primary station access routes, including the re-configuration of Curzon Street and New Canal Street, and highway improvements at the Curzon Street/Cardigan Street junctions, and at the A4540 Curzon Circle and Garrison Circus. The improvements are proposed at the junctions closest to the station, beyond which traffic will be dispersed. With the proposed mitigation, despite the increases in traffic during the morning and evening peak hours, this will not have a significant effect on congestion and delays in either 2026 or 2041.
- 12.5.21 Overall, with the proposed highway improvements, the average travel times and journey time delays for vehicles through the area will be similar to those forecast in the future baseline for 2026 and 2041.
- 12.5.22 The closure of the B4114 Park Street is likely to result in a traffic diversion of between 200m and 1.2km depending on the direction of travel. The diversion is not expected to have a significant effect on journey times.
- 12.5.23 The closure of Andover Street, Banbury Street, Bartholomew Street, Fazeley Street (west of New Canal Street), Freeman Street and Seymour Street, mainly provide access to areas that will be displaced as part of the development, and diversionary effects will not therefore be significant.
- 12.5.24 There will be a permanent loss of car parking at locations along the route. This includes a loss of private off-street car parking spaces, designated car parking spaces and loading bays. Where car parking is lost, and the facility it served is displaced by the Proposed Scheme, no demand for parking will exist and therefore no effect on parking will arise.
- 12.5.25 There will be a permanent loss of private off-street car parking at the following locations in the city centre:

- Curzon Street pay and display car park (loss of approximately 500 (100%) parking spaces);
- Seymour Street pay and display car park (loss of approximately 40 (100%) parking spaces); and
- Albert Street surface level pay and display car park (loss of approximately 200 (100%) parking spaces).

- 12.5.26 Occupancy of the Curzon Street, Seymour Street and Albert Street car parks was surveyed to be only a maximum of 400 users. There are approximately 5,000 car parking spaces in close proximity to Curzon Street station, with spare capacity throughout the day to accommodate any displaced demand. The loss of spaces will not therefore be significant.
- 12.5.27 The permanent loss of private off-street car parking will have a significant effect at the following locations in the Washwood Heath area:
- West Midlands Fire Service, located on St. James' Place (major adverse effect, resulting from the loss of 30 (up to 12%) parking spaces);
 - Cosway (UK) Ltd, located on Network Park (major adverse effect, resulting from the loss of 20 (47%) parking spaces); and
 - Salts Medilink Distribution Centre, located on Network Park (moderate adverse effect, resulting from the loss of 10 (100%) parking spaces).
- 12.5.28 There will be a loss of eight (100%) on-street pay and display parking spaces on Fazeley Street but these serve a wider area and there are a number of alternatives and this loss is not considered to be significant.
- 12.5.29 There will be a loss of loading facilities, with significant effects arising at the following locations:
- Salts Medilink Distribution Centre, located on Network Park (moderate adverse effect, due to the loss of one (33%) loading bay);
 - Crown International, located on Landor Street (moderate adverse effect, due to the loss of approximately 31 (around 54%) marked HGV parking spaces); and
 - Freightliner Terminal Depot, located on Landor Street (major adverse effect, due to the loss of approximately 40 (around 33%) unmarked HGV parking spaces).
- 12.5.30 HS2 Ltd will work with the businesses affected to identify opportunities where reasonably practicable to mitigate effects on parking.
- 12.5.31 The effect on accident and safety risks is not significant as there are no locations where there are existing highway safety issues and substantial increases in traffic due to the operation of the Proposed Scheme.
- 12.5.32 There are numerous bus routes that pick up in Birmingham city centre, close to Curzon Street station. In 2026, the Proposed Scheme will generate approximately

340 bus passengers in the morning peak hour and around 250 in the evening peak hour, and by 2041, 720 and 550 bus passengers respectively. This number of bus passengers generated by the Proposed Scheme will not have a significant effect on commercial bus services, which would be expected to adjust, where necessary, to meet additional demand.

- 12.5.33 The closure of the B4114 Park Street will result in the seven bus routes which currently use the B4114 Park Street (17, 58, 59, 60, 97, 900, 957) being diverted via the B4100 Moor Street Queensway. This will result in an increased journey distance of approximately 200m and an increased journey time of around 25 seconds. The effect of the bus route diversion will not be significant.
- 12.5.34 The closure will also result in the relocation of two bus stops and consequent increased travel distance for some users of the bus stops. The relocation of the bus stops will have a moderate adverse effect on the users of seven bus routes (17, 58, 59, 60, 97, 900 and 957).
- 12.5.35 In 2026, Curzon Street station will generate approximately 1,570 pedestrian movements in the morning peak hour and 1,680 in the evening peak hour, and by 2041, 4,310 and 4,620 respectively. These pedestrian movements will then be dispersed, primarily to the north and west. Of these, 60% are expected to head west to access buses, other rail stations, and facilities in Birmingham city centre. This will result in increased pedestrians on the B4100 Moor Street Queensway. The impact of increased pedestrian movements on the footways and crossings on the B4100 Moor Street Queensway, in-combination with the forecast increase in traffic due to the Proposed Scheme, has been analysed, and the existing facilities are considered adequate to provide for easy and safe pedestrian movements and result in no significant effects.
- 12.5.36 The Proposed Scheme will result in increased travel distance and consequent minor adverse effects on the users of one roadside footway and one footpath (on Viaduct Street, and the footpath (informal trodden path) across the grassed area between Banbury Street and Bartholomew Street), a moderate adverse effect on two links (Banbury Street and Bartholomew Street), and a major adverse effect on three links (Fazeley Street, B4114 Park Street, and the footpath across Park Street Gardens between Fazeley Street and the B4114 Park Street). The increased walking distances are due to the closure or diversion of roadside footways and footpaths. Four of the links result in an increased walking distance of more than 500m including Viaduct Street (700m) Fazeley Street (580m), the B4114 Park Street (680m) and the footpath across Park Street Gardens between Fazeley Street and the B4114 Park Street (770m).
- 12.5.37 The Proposed Scheme will have no impact or effect on waterways in this CFA.

Cumulative effects

- 12.5.38 The assessment includes the cumulative effects of planned development during operation by taking this into account within the background traffic growth.
- 12.5.39 The assessment also includes in-combination effects, by taking into account traffic and transport movements which pass through the area to access the proposed station at Birmingham Interchange (CFA24). In 2026, this equates to 124 vehicle trips in the

morning peak hour and 100 in the evening peak hour. For 2041, traffic flows of 236 (morning peak) and 194 (evening peak) have been included in the assessments. The traffic flows are assigned across various routes in this area.

Other mitigation measures

- 12.5.40 Potential improvements to the signal timings at junctions on the B4114 Moor Street Queensway and at the New Canal Street and Fazeley Street junction will be discussed with the highway authorities in the future. These have not been taken into account in the assessment but would help mitigate the Proposed Scheme effects.
- 12.5.41 The station and workplace travel plan will require travel plans to be used to mitigate the impacts of traffic and transport movements associated with the maintenance and operation of the Proposed Scheme. The effects of the travel plan measures for Curzon Street station and Washwood Heath depot have not been included in this assessment, which will mean the adverse effects may be over-stated.
- 12.5.42 No further mitigation measures for the operation of the Proposed Scheme are considered necessary based on the results of this assessment.

Summary of likely significant residual effects

- 12.5.43 The Proposed Scheme will have major significant beneficial effects for residents and businesses of this CFA including increased rail capacity on the Proposed Scheme and associated substantial reductions in journey times between Birmingham and London. The capacity released on the WCML will reduce crowding on local services and provide the opportunity to operate additional services.
- 12.5.44 There will be an increase in traffic associated with travel demand to and from Curzon Street station and the closure of the B4114 Park Street and reconfiguration of New Canal Street. The increase in traffic will affect pedestrians and cyclists crossing Curzon Street, between New Canal Street and Cardigan Street, New Canal Street, between Fazeley Street and Curzon Street, Cardigan Street, the B4100 Moor Street Queensway, Floodgate Street, between Fazeley Street and Moore's Row, Oxford Street, between Coventry Street and the B4100 High Street Deritend, Heath Mill Lane, between the B4100 High Street Deritend and Alcock Street, and Great Barr Street, between Derby Street and Fazeley Street.
- 12.5.45 Closure of the B4114 Park Street will result in the relocation of bus stops and increased travel distances for users of seven bus routes (17, 58, 59, 60, 97, 900 and 957).
- 12.5.46 There will be a permanent loss of car parking and/or loading areas at the West Midlands Fire Service, Freightliner, Crown International, Cosway (UK) Ltd, Serck, and Salts Medilink Distribution Centre.
- 12.5.47 Five roadside footways and two footpaths will be diverted (Viaduct Street, footpath between Banbury Street and Bartholomew Street, Banbury Street, Bartholomew Street, Fazeley Street, B4114 Park Street and footpath across Park Street Gardens), which extend journey times for pedestrians and cyclists.
- 12.5.48 The significant effects that result in this area from the Proposed Scheme in 2026 and 2041 are shown in Volume 5: Map TR-04-158b to TR-04-160.

13 Water resources and flood risk assessment

13.1 Introduction

- 13.1.1 This section provides a description of the current baseline conditions 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 features of relevance to water resources and flood risk include:
- the main rivers Rea and Tame and their associated floodplains, and the Washwood Heath Brook;
 - the River Rea Overflow Channel which is an ordinary watercourse;
 - the Grand Union and Digbeth Branch Canals;
 - the Bromsgrove Sandstone Principal aquifer;
 - the Permeable Superficial and Arden Sandstones Secondary A aquifers, along with the Mercia Mudstone Secondary B aquifer; and
 - seven licensed groundwater abstractions¹⁰⁷ throughout the Washwood Heath to Curzon Street area, six of which abstract directly from the Bromsgrove Sandstones and one from the Mercia Mudstones.
- 13.1.3 Key environmental aspects relating to water resources and flood risk include:
- the de-culverting and permanent diversion of the Washwood Heath Brook;
 - the permanent diversion of the River Rea Overflow Channel;
 - the temporary in-channel modification of the River Tame to the east of the Washwood Heath;
 - the temporary dewatering for the Bromford tunnel west portal construction;
 - the potential alteration of groundwater levels and mobilisation of existing poor quality groundwater by temporary dewatering during construction, and by permanent groundwater control during operation;
 - the potential obstruction to groundwater flow by below ground construction of the west tunnel portal and permanent structures during construction and operation potentially affecting local groundwater levels and groundwater flow to the River Tame;

¹⁰⁷ Environment Agency (2012), Environment Agency abstraction licences data.

- the potential for creation or alteration of contaminant pathways during construction and operation on groundwater quality throughout the area, particularly around industrial areas of Washwood Heath and Saltley; and
- potential impact on flood risk caused by construction works within the floodplains of the rivers Rea and Tame.

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;
- Water Framework Directive compliance assessment; and
- a route-wide Flood Risk Assessment.

13.1.5 Detailed reports on water resources and flood risk within this area are also contained in the Volume 5 Appendices. These include:

- Volume 5: Appendix WR-002-026 Water Resources Assessment report;
- Volume 5: Appendix WR-003-026 Flood Risk Assessment;
- Volume 5: Appendix WR-004-019 Hydraulic modelling report for the River Tame;
- Volume 5: Appendix WR-004-020 Groundwater modelling report for the Bromford tunnel portals; and
- Volume 5: Appendix WR-004-021 River modelling of the River Rea technical report.

13.1.6 Volume 5: Map series WR-01, WR-02, WR-03, WR05 and WR-06 show details referred to in this report.

13.1.7 Discussions have been held with the Environment Agency, Natural England, the Canal and River Trust (formerly British Waterways), Severn Trent Water Ltd and Birmingham City Council (BCC) as Lead Local Flood Authority.

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 and in the Scope and Methodology Report (SMR) and its addendum presented in Volume 5: Appendix CT-001-000/1 and 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 centreline 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 centreline of the route, 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 Site visits were carried out for locations along the route. Site visits were undertaken in June 2012 and January 2013 to the area of the proposed river works. Due to the Washwood Heath Brook being largely culverted, viewing the actual location of the brook was not possible.
- 13.2.4 Baseline surface water levels, flows and quality have not been monitored as part of this assessment. The assessment is based upon flows provided by publicly available data from the National Rivers Flow Archive¹⁰⁸ for the study area catchments.
- 13.2.5 Water Framework Directive (WFD)¹⁰⁹ 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)¹¹⁰, 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 River Basin Management Plan, these are referred to as 'not assessed by the Environment Agency' in the summary of geology and hydrogeology in tables 14 & 15 below and Volume 5: Appendix WR-002-026.
- 13.2.6 The key assumptions for water resources and the FRA specific to this area are as follows:
- Washwood Heath Brook, the River Rea and the River Rea Overflow Channel interact with groundwater in a similar manner to the River Tame (with groundwater providing a proportion of the base flow) where these watercourses are not significantly lined or culverted;
 - actual baseline groundwater levels and water quality under the Proposed Scheme will be identified through future ground investigations prior to construction; and
 - for the purposes of groundwater control for tunnelling it is assumed that the tunnel boring machine (TBM) will be operated in a closed faced mode when tunnelling within water bearing strata. It is also assumed that the tunnel lining will be designed to minimise water ingress and any leakage rate will be negligible; and
 - It is assumed that groundwater levels vary in a similar fashion to topography throughout the study area, with groundwater level contours roughly parallel to topographic contours. In the absence of more detailed information, it has been

¹⁰⁸ Centre for Ecology and Hydrology; *National River Flow Archive*, www.ceh.ac.uk/data/nrfa; Accessed June 2013.

¹⁰⁹ The Water Framework Directive – Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy, Europa Commission, (2000).

¹¹⁰ Environment Agency; *Humber River Basin Management Plan*, www.environment-agency.gov.uk/research/planning/124803; Accessed: June 2013.

generally assumed that groundwater levels are within 1m of the ground surface, with flow towards watercourses.

13.2.7 The main limitations for the water resources and flood risk assessment in this area are as follows:

- limited monitoring data was available with regard to baseline groundwater levels, flows and quality. Where available, reports that provide measurements of groundwater strikes or rest water levels measured immediately following borehole excavation, have been used to assess the likely position of the water table;
- site specific hydraulic models supplied by the Environment Agency for the rivers Rea and Tame have been refined to enable their use relating to the proposed works. Model reports clarifying these changes, and limitations, are provided in Volume 5: WR-003-026 Flood Risk Assessment;
- the size and condition of the existing River Rea overflow, intake, culverts and discharge have been assumed where data have not been provided; and
- groundwater level data from the Environment Agency and other monitored locations such as private abstractions and borehole excavations are limited in the study area.

13.2.8 Notwithstanding the limitations outlined above, it is considered that an appropriate level of assessment has been undertaken and the conclusions drawn are valid.

13.3 Environmental baseline

Existing baseline – surface water resources

Surface water features

- 13.3.1 All water bodies within the study area fall within the Tame, Anker and Mease catchment within the Humber River Basin District (RBD) as set out in the RBMP. This includes the River Tame, the River Rea and Washwood Heath Brook, together with the Digbeth Branch and Grand Union Canals.
- 13.3.2 The River Tame is the most significant watercourse in the West Midlands conurbation, draining a total catchment of 1,500km² before discharging into the River Trent at Alrewas and is classified as a main river. The River Tame catchment upstream of Washwood Heath is approximately 350km². The River Rea, also a main river, is a tributary of the River Tame and has a total catchment of 87km².
- 13.3.3 The River Rea joins the River Tame in the vicinity of Washwood Heath near the A47 Heartlands Parkway and toward the eastern extent of the study area.
- 13.3.4 The current surface water baseline is shown on Volume 5: Map WR-01-043 and all surface water features within the study area are assessed within Volume 5: Appendix WR-002-026. Table 18 includes features potentially affected by the Proposed Scheme.

Table 18: Surface Water Features potentially affected by the Proposed Scheme

Water feature	Location description (map reference ¹¹¹)	Watercourse Classification ¹¹²	Water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value ¹¹³
River Tame	Flowing eastwards from Washwood Heath area (SWC-CFA26-001, H5)	Main river	(GB104028046840) Moderate Heavily modified	Good Potential	High
River Rea	Flowing eastwards towards confluence with River Tame in Washwood Heath area (SWC-CFA26-003, E6)	Main river	(GB104028042550) Bad Heavily modified	Good Potential	High
Washwood Heath Brook	Flowing north-east through the Washwood Heath area (H5)	Ordinary watercourse	No status shown in RBMP – assumed status Moderate	No status shown in RBMP – assumed status Good Potential	Moderate
Grand Union Canal and Digbeth Branch Canal	Passing under the route south of the Saltley Business Park area (SWC-CFA26-002, F5 & SWC-CFA26-004, D6)	Artificial not applicable	(GB70410204) Moderate Artificial	Good Potential	High
River Rea Overflow Channel	Overflow channel originating west of Saltley Business Park passing under Aston Church Road and into culvert under the gas works (F5)	Ordinary watercourse	No status shown in RBMP, assumed status Bad	No status shown in RBMP – assumed status Good Potential	Moderate

* year may vary in different RBMPs.

¹¹¹ see Volume 5: Map WR-01-043.

¹¹² Environment Agency water-feature classification: The Land Drainage Act 1991 (ch59); London, Her Majesty's Stationery Office, defines an Ordinary watercourse as 'A watercourse that is not part of a main river, 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, main rivers are regulated by the Environment Agency.

¹¹³ For examples of receptor value see Table 43 in the SMR Addendum (see Volume 5, Appendix CT-001-000/2).

Water Framework Directive status

- 13.3.5 The Environment Agency has set the status objective under the WFD for the River Tame, River Rea, Grand Union and Digbeth Branch Canal by 2027 to be of Good Potential. This is an improvement compared to the current overall status which is Moderate Status for the River Tame and the Grand Union and Digbeth Branch Canals, and Bad Status for the River Rea.

Abstractions and permitted discharges

- 13.3.6 There are no licensed surface water abstractions within the Washwood Heath to Curzon Street study area¹¹⁴.
- 13.3.7 The Environment Agency reports that there are 41 current consented surface water discharges within 500m of the centre line of the route in the study area. There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20 cubic metres per day. Details are provided in Volume 5: Appendix WR-002-026.

Existing baseline – groundwater resources

Geology and hydrogeology

- 13.3.8 The location of abstractions, geological formations and indicative groundwater levels, where available, are shown on Volume 5: Map WR-02-026.
- 13.3.9 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 19. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 19: Summary of geology and hydrogeology in Washwood Heath to Curzon Street CFA

Geology	Distribution	Formation description	Aquifer classification	WFD body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value
Superficial deposits						
Alluvium	Valley bottom of Rivers Tame and Rea.	An upper layer of clay or silt, underlain by several metres of pebbly sand and gravel.	Secondary A ¹¹⁵	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
River Terrace Deposits	Valley bottom of Rivers Tame and Rea.	Gravel or very clayey sand and gravel.	Secondary A	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Glacial Sands and Gravels	Discontinuous along upper parts of Rivers Rea and	Poorly sorted, sand, clayey sand, pebbly sand and	Secondary A	Not assessed by the Environment	Not assessed by the Environment	Moderate

¹¹⁴ Public water supply abstractions not included.

¹¹⁵ "Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers" (Environment Agency; www.environment-agency.gov.uk; Accessed June 2013).

Geology	Distribution	Formation description	Aquifer classification	WFD body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value
	Tame.	gravel.		Agency	Agency	
Bedrock						
Mercia Mudstone (Mercia Mudstone)	East of Birmingham Fault	Mudstone and dolomitic siltstone.	Secondary B ¹¹⁶	(GB40402G990800) Poor ¹¹⁷	Tame, Anker and Mease – Secondary Combined ¹¹⁸ – Good	Moderate
Arden Sandstone (Mercia Mudstone)	Thin horizon within Mercia Mudstone. Outcrop towards the east of study area.	Siltstones and sandstones; local beds of conglomerate.	Secondary A	(GB40402G990800) Poor	Tame, Anker and Mease – Secondary Combined – Good	Moderate
Bromsgrove Sandstone (Sherwood Sandstone)	West of Birmingham Fault.	Sandstone	Principal ¹¹⁹	(GB40401G301000) Poor	Tame, Anker and Mease – Sandstone Birmingham Lichfield – Good	High

* year may vary in different RBMPs.

Superficial deposits

- 13.3.10 Superficial glacial deposits form a discontinuous layer across the upper parts of the River Rea Valley and River Tame Valley sides. In particular, glacial deposits are present across the area east of Aston Church Road and continue beneath this section of the Proposed Scheme as far as the proposed Curzon Street station. A notable feature is a buried glacial channel up to 30m deep and infilled with glacial deposits. This occurs south of the former Leyland DAF Vans (LDV) factory site and continues south of Saltley Business Park up to Aston Church Road and Network Park industrial estate. The route of the Proposed Scheme will follow the valley bottom of the River Tame and River Rea, an area that is underlain by widespread deposits of alluvium and River Terrace Deposits.
- 13.3.11 The glaciofluvial deposits, river terrace alluvial deposits are Secondary A aquifers.

Bedrock aquifers

- 13.3.12 The underlying solid geology comprises Mercia Mudstone Group as far west as the Birmingham Fault, which approximately follows the line of the River Rea valley. Mercia Mudstone typically comprises a weak red brown silty mudstone with minor

¹¹⁶ "Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering" (Environment Agency; www.environment-agency.gov.uk; Accessed June 2013).

¹¹⁷ Environment Agency, (2008); *The Tame, Anker and Mease Catchment Abstraction Management Strategy*; Environment Agency.

¹¹⁸ Environment Agency, (2009); *River Basin Management Plan Humber River Basin District*.

¹¹⁹ "...layers of rock or drift deposits that have high intergranular and/or fracture permeability... (and)... may support water supply and/or river base flow on a strategic scale" (Environment Agency; www.environment-agency.gov.uk; Accessed June 2013).

amounts of carbonate and gypsum when unweathered. The Arden Sandstone Formation occurs within the Mercia Mudstone as a thin discontinuous horizon of siltstone and sandstone, although this is much higher in the sequence, to the east of Birmingham.

- 13.3.13 The Bromsgrove Sandstone Formation, a Principal aquifer, which is part of the Sherwood Sandstone Group, is present to the west of the Birmingham Fault across the remainder of the study area. The geological formations within this study area are described in detail in the Volume 5: Appendix WR-002-026.
- 13.3.14 The Mercia Mudstone Group are a Secondary B aquifer, and the Arden Sandstone is a Secondary A aquifer.

Water Framework Directive status

- 13.3.15 No WFD classification has been given by the Environment Agency to the superficial deposits.
- 13.3.16 The overall WFD status of the Tame Anker and Mease – Secondary Combined and the Tame, Anker and Mease – Sandstone Birmingham-Lichfield is summarised in Table 19 and are classified as Poor Status. The main pressures, across the whole of the catchment, identified in the RBMP on the quality of groundwater are high or rising nitrate concentrations and failures for pesticides and chemicals associated with mine workings in the wider area¹²⁰.

Abstractions and permitted discharges

- 13.3.17 According to the Environment Agency and BCC records, there are seven licensed groundwater abstractions, which abstract directly from the Bromsgrove Sandstones and Mercia Mudstone aquifers. The abstraction licence details are presented in Volume 5: Appendix WR-002-026. There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20 cubic metres per day.
- 13.3.18 According to the Environment Agency Source Protection Zone (SPZ) mapping, three source protection zones are within the study area, but these are not crossed by the route of the Proposed Scheme. These are associated with the Aston Manor, Grand Hotel, and Midlands (Burlington) Hotel abstractions. Further details are presented in Volume 5: Appendix WR-002-026, and on Volume 5: Map WR-02-026.
- 13.3.19 According to the Environment Agency data there are no groundwater discharge consents located within the study area.

Surface water/groundwater interaction

- 13.3.20 The main rivers Tame and Rea act as discharge points for converging groundwater flows in the region. The permeable superficial deposits underlying the Rea and Tame allow a significant inflow of shallow groundwater, where the rivers are not culverted or heavily modified with a lined channel¹²¹. The rivers Rea and Tame are classified as high

¹²⁰ Environment Agency, (2009); *River Basin Management Plan: Humber River Basin District*.

¹²¹ Knipe, C.V., Lloyd, J.W., Lerner, D.N. and Greswell, R. (1993); *Rising Groundwater levels in Birmingham and the engineering implications*, CIRIA Special Publication, No. 92; Construction Industry Research and Information Association.

value receptors. Borehole logs from the British Geological Survey (BGS) give an approximate indication of the groundwater levels and suggest that groundwater in the valley bottom within the superficial deposits is approximately 2m to 6m below ground level and flows towards the River Tame.

- 13.3.21 In order to better understand the likely effects of the proposed tunnel and the west tunnel portal on shallow groundwater and its interaction with the River Tame, a preliminary numerical groundwater model has been developed. The model describes the likely shallow groundwater flow regime in the vicinity of the proposed tunnel portal based on the limited available data. The conceptual model and details of the numerical model are outlined in Volume 5: Appendix-004-020.
- 13.3.22 No springs have been identified from Ordnance Survey base mapping within the study area.

Water dependent habitats

- 13.3.23 There are no areas with statutory ecological designations in relation to surface water or groundwater dependent terrestrial ecosystems located in the study area.

Existing baseline – flood risk

River flooding

- 13.3.24 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping, see Volume 5: Map-01-043. Within this study area the rivers Rea and Tame are main rivers.
- 13.3.25 The majority of the River Tame catchment is heavily urbanised and the river's channel has been extensively modified along a large proportion of its length.
- 13.3.26 The route of the River Tame flowing eastwards is shown on Volume 5: Map WR-01-043. As the river leaves this study area, it becomes a heavily modified two stage concrete channel with a line of piers located in between the two channels.
- 13.3.27 In order to establish the existing flood risk posed by the River Tame to the land located along (and adjacent to) the route, reference has initially been made to the existing Environment Agency flood zone mapping shown on Volume 5: Map WR-01-043.
- 13.3.28 The Environment Agency flood zone mapping indicates that there are areas at risk of inundation from the River Tame during a 1 in 100 annual probability river flood event (1%). The areas of land currently at high risk from inundation from the River Tame are shown in Volume 5: Map WR-01-043. Details of areas at high risk (Flood Zone 3) of flooding are included within Volume 5: Appendix WR-003-026 Flood Risk Assessment. These are as follows:
- the north east extent of Gravelly Industrial Park;
 - the east boundary of Hurricane Park;
 - the east extent of Washwood Heath railway sidings;

- the central section of Bromford Lane/A47 roundabout; and
- sections of the Birmingham to Derby line where the railway runs adjacent to the M6.

- 13.3.29 The Environment Agency modelling has been refined and updated for this assessment, in consultation with the Environment Agency, and includes an allowance for climate change in accordance with National Planning Policy Framework (NPPF)¹²² guidelines. The updated results of the modelling are included within Volume 5: Appendix WR-003-026 Flood Risk Assessment and shown in Volume 5: Maps WR-05-158b and WR-05-160.
- 13.3.30 The River Rea is a major tributary of the River Tame draining south-west Birmingham and the surrounding rural areas. It has a total catchment of 87 km². As a main river it is regulated by the Environment Agency. In the study area, it flows within a heavily modified brick lined channel through an urbanised industrial area of Birmingham located between the Birmingham and Bushbury line and the Birmingham and Derby line for approximately 3.5km. The confluence of the rivers Rea and Tame is within the Washwood Heath area of the city at a location to the north of the existing Washwood Heath railway sidings.
- 13.3.31 To the east of the Aston Church Road/A47 Heartlands Parkway roundabout there is an overflow channel to the existing River Rea. This is not designated as a main river. This channel appears to take excess flow from the River Rea during flood events. It may also take water from the Grand Union Canal and accept surface water discharges from the Severn Trent Water sewerage system. This overflow channel was the original course of the River Rea before industrialisation. In addition, there is a mill channel that initially diverted flows away from the main River Rea channel. The hydraulics of the two channels have been re-engineered, so that the main channel of the River Rea now flows parallel to the Grand Union Canal while the original course of the Rea is the overflow channel. More recently, this has been culverted downstream under an area of land now used as Washwood Heath gas storage facility. See Volume 5: Appendix WR-004-021 for further details.
- 13.3.32 The Environment Agency flood zone mapping shown on Volume 5: Map WR-01-043, indicates that a localised area of land in the vicinity of Saltley Viaduct along the Proposed Scheme is currently within Flood Zone 3. This indicates that it is at high risk from inundation from the River Rea; it is inundated during a flood event with a 1 in 100 annual probability (1%) of river flooding including climate change. From the site specific modelling undertaken the areas at risk, of flooding during a flood event with a 1 in 100 annual probability (1%) of river flooding including climate change, and their value as receptors, are:
- a small area of inundation east of the main channel, approximately zoom downstream of Duddeston Mill Road (less vulnerable receptor of moderate value);

¹²² Department for Communities and Local Government, (2012), *National Planning Policy Framework*.

- flood waters are indicated to inundate the Birmingham and Derby line and flow into Grand Union Canal upstream of the culvert under A47 Heartlands Parkway, immediately downstream of B4114 Saltley viaduct (essential infrastructure receptor of very high value); and
- inundation of the existing Grand Union Canal between Aston Church Road and B4114 Saltley Viaduct (water compatible development of low value).

13.3.33 Washwood Heath Brook is a tributary of the River Tame and is an ordinary watercourse. It drains an urban area to the south of Washwood Heath. The majority of its course is culverted, although there is a short reach of open channel located within the proposed Washwood Heath depot.

13.3.34 The site specific baseline modelling of the River Tame catchment indicates localised inundation of flood waters from the open section of the brook during the 1 in 100 annual probability (1%) plus climate change river flood event. This comprises land within the proposed Washwood Heath depot area.

Surface water flooding

13.3.35 The agreed data set for surface water flooding is the Environment Agency Flood Map for Surface Water (FMfSW), as shown on Volume 5: Map WR-01-043. Within the study area there are numerous existing overland flow routes and low points that have the potential to be inundated during intense rainfall events. These have the potential to cause localised flooding in the vicinity of the Proposed Scheme.

13.3.36 The FRA in Volume 5: Appendix WR-003-026 presents the Environment Agency maps showing areas susceptible to surface water flooding from the FMfSW mapping. The areas susceptible to potential flooding from a 1 in 200 annual probability (0.5%) rainfall event occurring are shown on the Volume 5, Map WR-01-043. The maps show existing areas at risk from surface water flooding. The maps also show surface water flooding in distinct local low points within the city centre, as well as watercourses and canals. The following are the areas along or in close proximity to the route where overland flow may be a flood risk are:

- the A4540, Lawley Middleway where the road passes under the existing railway bridge;
- Duddeston Mill Road under the existing rail bridge;
- an industrial area in the Vauxhall area of Birmingham south of Saltley viaduct; and
- Saltley Business Park.

13.3.37 An instance of historic flooding in the Bromford area has been attributed to overland flow. This is identified in BCC's SFRA. This is not indicated to be in close proximity to the Scheme.

Sewer flooding

- 13.3.38 The agreed dataset for sewer flooding is the Preliminary Flood Risk Assessment (PFRA)¹²³ and the BCC Level 1 Strategic Flood Risk Assessment (SFRA)¹²⁴. The Flood Risk Assessment includes information on sewers and historical flooding records. It is noted within the BCC Level 1 SFRA that “reported sewer and surface water flooding locations correspond with the areas at risk of surface water flooding”. The majority of the drainage systems will be the responsibility of Severn Trent Water and the BCC for highway drainage.
- 13.3.39 The proposed construction of the Washwood Heath depot will require the diversion of a number of combined foul and surface water sewers. In addition, works will be undertaken to accommodate drainage from the Birmingham and Derby line. These works will be undertaken in consultation with Severn Trent Water, BCC and Network Rail to ensure there is no increased risk of sewer flooding.

Artificial water bodies

- 13.3.40 The agreed dataset for reservoir flooding is the Environment Agency Reservoir Inundation Map¹²⁵.
- 13.3.41 Flooding from artificial systems may occur from failure of a retaining structure which impounds water. The following man-made features have been identified within the Volume 5: Appendix WR-003-026 Flood Risk Assessment as being a potential source of flood risk:
- the canal system; and
 - reservoirs.
- 13.3.42 The two features related to Birmingham’s extensive canal system crossed by the route are:
- Grand Union Canal (crossed by the route 50m north of the B4114 Saltley Viaduct); and
 - Digbeth Branch Canal (crossed by the route 150m west of the A4540 Lawley Middleway).
- 13.3.43 The Digbeth Branch Canal connects the Grand Union Canal to the Birmingham and Fazeley Canal. Overtopping of the canal in this location is not physically possible due to the relative elevation of the canal compared to surrounding topography. The Grand Union Canal will be crossed in the vicinity of the B4114 Saltley Viaduct. Localised overtopping of this canal is extremely unlikely based on the relative levels of the canal and the surrounding topography.
- 13.3.44 The Environment Agency reservoir inundation maps indicate that in the event of a reservoir breach there are three water bodies that have the potential to inundate the River Rea valley and six water bodies that have the potential to inundate the River

¹²³ Birmingham City Council, (2011), *Preliminary Flood Risk Assessment*.

¹²⁴ Atkins (2012), *Birmingham City Council Level 1 Strategic Flood Risk Assessment*.

¹²⁵ Environment Agency (2012), *Reservoir Flood Mapping*, <http://www.environment-agency.gov.uk/>; Accessed June 2013.

Tame valley in the vicinity of the study area. These are listed within Volume 5: Appendix WR-003-026 Flood Risk Assessment.

- 13.3.45 In most areas, the extent of inundation will be approximately equivalent to the 1 in 1,000 annual probability event (0.1%). However, the Environment Agency data provided does not indicate flood depths, flow velocities or the time taken for onset of flooding after a breach takes place.
- 13.3.46 The likelihood of such flooding occurring is extremely low and given the distance of the route from the reservoirs and the fact that the Proposed Scheme will not increase the residual risk of reservoir failure, it has not been considered further within this assessment. Further details can be found in Volume 5: Appendix WR-003-026 Flood Risk Assessment.

Groundwater flooding

- 13.3.47 The agreed dataset for groundwater flooding is the BCC Level 1 Strategic Flood Risk Assessment (SFRA) and the PFRA.
- 13.3.48 The BCC Level 1 SFRA includes information from the Construction Industry Research and Information Association (CIRIA) 1993 Report "Rising groundwater levels in Birmingham and the engineering implications"¹²⁶ and the Environment Agency 2006 report "Making space for groundwater"¹²⁷.
- 13.3.49 The main area of groundwater flood risk identified in these reports is the area west of the Birmingham Fault within the Sherwood Sandstone Group (Bromsgrove Formation) on the approach to Curzon Street. During the last 40 years there has been an appreciable reduction in the amount of pumping in the area, leading to a rise in groundwater levels. The Bromsgrove sandstone has experienced rising groundwater levels during the last 30 years with warnings of groundwater flooding in parts of the city.

Future baseline

- 13.3.50 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.
- 13.3.51 All developments are required to comply with the National Planning Policy Framework (NPPF)¹²⁸, development plans and other legislation and guidance. As such committed developments should have a neutral effect on the water resources and flood risk baseline.

¹²⁶ CIRIA, (1993), *Rising groundwater levels in Birmingham and engineering implications:SP2*, CIRIA, London.

¹²⁷ Jacobs, (2006), *Making space for groundwater*, Environment Agency.

¹²⁸ Department for Communities and Local Government (2012) *National Planning Policy Framework Technical Guidance*.

- 13.3.52 Within the Birmingham city area there are no committed developments identified that are likely to cause significant changes to the water resources and flood risk baseline prior to construction of the Proposed Scheme.
- 13.3.53 WFD future status objectives are set out in Table 18 and Table 19. These are not considered to result in significant changes to the reported effects from the Proposed Scheme.

Climate change

- 13.3.54 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 changes are not considered to result in the reported effects from the Proposed Scheme changing in significance.
- 13.3.55 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.
- 13.3.56 When considering the influence that climate change may have on the future baseline against which 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 National Planning Policy Framework¹²⁹. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.
- 13.3.57 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Volume 1 and Table 13 in Volume 5: Appendix CT-001-000/02-000.

13.4 Effects arising during construction

Avoidance and mitigation measures

- 13.4.1 The general approach to mitigation is set out in Volume 1.
- 13.4.2 The following avoidance and mitigation measures will in many cases reduce potentially significant adverse effects on water resources and flood risk to levels that will not be significant. Further details are shown in Volume 5: Appendix WR-002-026 and WR-003-026.
- 13.4.3 The Washwood Heath Brook, an ordinary watercourse, will be permanently diverted through the proposed Washwood Heath depot to its southern edge. This diversion removes a section of the brook from culvert and the channel design will result in no

¹²⁹ Department for Communities and Local Government, March 2012, *National Planning Policy Framework*.

increase in flood risk. Consideration will be given in the design to the objectives of the WFD as described in the River Basin Management Plan. This may include the use of soft engineering solutions for bank design, and the inclusion of natural forms such as berms or riffles and pools and marginal planting, where reasonably practicable and designed in consultation with the Environment Agency.

- 13.4.4 The River Rea Overflow Channel will be permanently realigned adjacent to the route of the Proposed Scheme and will avoid the channel passing under the route at two locations. Consideration will be given in the design of the realignment to the WFD objectives as described in the RBMP. This may include the use of soft engineering solutions for bank design, the inclusion of natural forms, riffles, pools and marginal planting where reasonably practicable and designed in consultation with the Environment Agency.
- 13.4.5 The drainage design will take into account the principles of Sustainable Drainage Systems (SuDS). It is currently envisaged that this will include the provision of eight balancing ponds, located as follows:
- three in the proposed Washwood Heath depot (see Volume 2: Map CT-06-139b, G6-E7);
 - one adjacent to the B4114 Saltley Viaduct (see Volume 2: Map CT-06-140, C6);
 - two in the Vauxhall area (see Volume 2: Map CT-06-141, H5 and G6);
 - one near Erskine Street (see Volume 2: Map CT-06-141, E7); and
 - one situated to the east of Curzon Street station, near Curzon Circle (see Volume 2: Map CT-06-142, I5).
- 13.4.6 The balancing ponds will provide mitigation to ensure that rainfall run-off from the route will be released in a controlled manner to the receiving watercourses reducing the potential for adverse impact on the water quality and flow of the receiving watercourse. The balancing ponds will be designed where practicable to discharge at existing run-off rates and will accommodate events up to and including the 1 in 100 annual probability (1%) event including an allowance for climate change.
- 13.4.7 Measures to ensure the minimisation of any effects on groundwater during the construction of cuttings and excavations, utility diversions and permanent groundwater effects due to the presence of the west tunnel portal cutting are included within the draft CoCP (Section 16). Further details of the cuttings and excavations are summarised in Volume 5: Appendix WR-002-026. The following measures will reduce adverse potential permanent effects on groundwater flow, to levels that will not be significant. Measures will be implemented, where appropriate, following detailed pre-construction ground investigations and may include:
- install cut-off structures around excavations;
 - ensure cut-off structures are driven to sufficient depths to meet an underlying strata or zone of lower permeability;

- promote groundwater recharge, such as discharging pumped water to recharge trenches around excavations to maintain baseline groundwater and surface water conditions;
- incorporate passive bypasses within the design, which could comprise a 'blanket' of permeable material, such as gravel, placed below cuttings or around structures allowing groundwater to bypass the foundations of the viaducts and bridges, without a rise in groundwater levels on the upstream side; and
- pumping excess groundwater from the portal area to maintain acceptable groundwater levels.

- 13.4.8 To ensure no significant changes in flood risk, the design includes the provision of flood culverts and flood arches to ensure connectivity of potential flood flow routes in the area of Washwood Heath and across the Rea and Tame valley. Moreover, a proportion of the route in this area will be on viaduct thus minimising change to existing surface water flooding flow pathways and the potential for an increase in flood risk.
- 13.4.9 The River Tame, a main river, will require the construction of a temporary localised narrowing of the existing channel adjacent to the Bromford tunnel west portal together with a temporary raising of the river banks immediately upstream. The temporary works will be designed to pass a 1 in 10 annual probability (10%) river flood event without an increase in flood risk to third parties or the temporary works. For flood events greater than the 1 in 10 annual probability (10%) river flood event the full existing channel capacity will be reinstated in order to avoid any significant increase in flood risk to third parties for events up to and including the 1 in 100 annual probability (1%) river flooding event plus climate change. This will allow safe construction access to the river bed for the construction of a concrete slab in the base of the river, and ensure that there is no significant increase in flood risk to third parties. The construction of the slab is required to strengthen the river bed to enable the tunnel to be constructed beneath. Where reasonably practicable the concrete slab will be set below the existing firm bed of the watercourse.
- 13.4.10 The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme (Volume 5: Appendix CT-003-000). It will provide effective management and control of the impacts during the construction period.
- 13.4.11 The following measures in the draft CoCP will reduce potentially significant adverse effects arising during construction on water resources and flood risk:
- Method statements for surface water crossings and diversions, in consultation with the Environment Agency and other relevant regulators, to ensure that any temporary impacts on surface water and groundwater quality and flow are acceptable. This will ensure that there will be no significant effects on surface water quality or flows associated with construction;
 - implementing, in consultation with the Environment Agency and Lead Local Flood Authorities (LLFAs), a surface water and/or groundwater monitoring

plan as required, particularly in relation to works which may affect groundwater sensitive areas such as within the Bromford tunnel west portal excavation area;

- undertaking site-specific risk assessments, as required, associated with excavation work (e.g. in the proposed Washwood Heath depot area) and dewatering impacts on surface water, groundwater and abstractions;
- preparing site-specific flood risk management plans for those construction areas at risk of flooding such as for works in the vicinity of the River Tame;
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect water resources and flood risk during construction; and
- following the measures outlined for the provision of suitable site drainage at compounds and satellite compounds, for the storage and control of oils and chemicals and to mitigate against accidental spillages.

- 13.4.12 In accordance with the draft CoCP, Section 16, monitoring will be undertaken in consultation with the Environment Agency prior to, during and post-construction, if required, to establish baseline conditions for surface water and groundwater and to confirm the effectiveness of agreed temporary and permanent mitigation measures.

Assessment of impacts and effects

- 13.4.13 This section describes the significant effects following the implementation of avoidance and mitigation measures.
- 13.4.14 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-002-026 and FRA in Volume 5: Appendix WR-003-026.
- 13.4.15 An assessment of the impact on the WFD status is detailed within the WFD Compliance Assessment, contained within Volume 5: Appendix WR-001-000 Water Framework Directive compliance assessment.
- 13.4.16 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

- 13.4.17 The assessment shows that there will be no significant temporary adverse effects on surface water resources during the construction period.

Groundwater

- 13.4.18 There are considered to be no significant temporary effects on groundwater or the River Tame during construction.

- 13.4.19 There are no water dependent habitats in this study area and therefore no significant temporary effects to groundwater dependent habitats have been identified.

Flooding

- 13.4.20 There are considered to be no significant temporary effects on flood risk during construction.

Cumulative effects

- 13.4.21 There are no committed developments that have been identified which will result in significant cumulative temporary effects.

Permanent effects

Surface water

- 13.4.22 Subject to the correct implementation of all mitigation measures there are considered to be no significant adverse effects on surface water following the construction period.
- 13.4.23 The diversion and de-culverting of the Washwood Heath Brook will have a beneficial effect on this watercourse. De-culverting of the Washwood Heath Brook will ensure that the watercourse will be open to natural daylight for an additional 200m, although the final 140m before the joining the River Tame will remain in culvert. There is also the potential for the dissolved oxygen balance of the Washwood Heath Brook to improve due to the increased daylight. This de-culverting will also allow improved access to the watercourse and reduces the risk of blockage and failure associated with the existing watercourse. This will result in a moderate beneficial impact and a moderate effect which is significant.
- 13.4.24 There are considered to be no further significant permanent effects arising during construction that will continue into the operational phase of the Proposed Scheme for surface water.

Groundwater

- 13.4.25 The Bromford tunnel west portal will be located adjacent to the Washwood Heath depot area. The tunnel portal will include walls constructed around the portal. These walls will extend through the superficial deposits into the underlying Mercia Mudstone bedrock with the potential to alter groundwater flows and levels within the superficial deposits. This could result in a moderate adverse impact and a significant effect to local groundwater levels and flows.
- 13.4.26 Further assessment will be undertaken prior to construction to better understand and verify the magnitude of this effect. Further detail is contained in Volume 5: Appendix WR-002-026 Water resources assessment report. Potential further mitigation for this is described below.
- 13.4.27 There are considered to be no further significant permanent effects arising during construction.

Flood risk

- 13.4.28 The potential for localised increases in groundwater levels, affecting the risk of groundwater flooding, in the vicinity of the west tunnel portal has been identified. Further assessment and monitoring will be undertaken during construction. Other mitigation, if required, is outlined below.
- 13.4.29 The assessment shows there will be no other significant permanent adverse effects on flood risk.

Other mitigation measures

- 13.4.30 No other mitigation measures are considered necessary for surface water. With regard to groundwater in the vicinity of the tunnel west portal and potential impact on groundwater flood risk, should the further assessment identify a significant effect on groundwater levels and flow, this permanent effect could be mitigated by a variety of measures such as the inclusion of additional bypass drainage and if deemed necessary, temporary pumping when groundwater levels are high.
- 13.4.31 This will allow groundwater to bypass the portal without a rise in groundwater levels on the upstream side and will reduce the effect on groundwater and groundwater flooding to not significant.
- 13.4.32 No other mitigation measures are considered necessary for groundwater.
- 13.4.33 No other mitigation measures are envisaged for reducing flood risk.

Summary of likely significant residual effects

- 13.4.34 There will be a permanent beneficial effect in the opening up and increased natural light levels to Washwood Heath Brook.

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 watercourses and groundwater bodies during operation and management of the Proposed Scheme are described in Volume 1 and in the draft operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.
- 13.5.2 Specific design measures that mitigate/reduce impacts to levels that are not significant in relation to water quality and pollution risk include the balancing ponds incorporated within the design of the Proposed Scheme. The locations of these are described in Section 13.4. The balancing ponds are primarily for balancing run-off, but as well as providing water quality benefits. The design has included the provision for access to balancing ponds, watercourses and structures to allow for future maintenance during operation. These mitigation measures will also control discharges from the route and result in a negligible effect on water quality for the Rivers Rea and Tame.

- 13.5.3 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 watercourses and groundwater bodies are described in Volume 1 and in the draft operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.
- 13.5.4 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 passes. Generic examples of management measures that may mitigate flood risk are described in Volume 1 and Volume 5: Appendix WR-003-026.

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 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 residual significant effects

- 13.5.7 There are considered to be no significant adverse effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.

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